John Williams.

March 14th. 1874.

THE MASON'S, BRICKLAYER'S, PLASTERER'S AND DECORATOR'S PRACTICAL GUIDE.

Riginald de Bray William of Wykeham

WREN SCOTT BARRY

CONTAINING A
COMPLETE ELUCIDATION OF THOSE ARTS
AS
PRACTISED AT THE PRESENT TIME,
WITH
SUGGESTIONS AND IMPROVEMENTS
IN

CONSTRUCTIVE AND ORNAMENTAL MASONRY,

WITH EXAMPLES OF
Foundations, Domes, Lighthouses,
BRIDGES, WALLS, VAULTING,
ARCHES, DOORWAYS, WINDOWS,
ETC., ETC.; ALSO
A SERIES OF PRACTICAL DESIGNS
FOR
Cemetery Monuments, Tomb & Head-Stones,
Wall-Tablets, &c.

EDITED BY
ROBERT ROBSON,
ASSISTED BY
EMINENT ARCHITECTS & BUILDERS.

James Hagger, 67, Paternoster Row.
London

Robson Desig.

LIST OF PLATES.

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NOTICE.

In the issue of some of the earlier numbers, a few inaccuracies have inadvertently occurred as respects the numbering of the Plates, which in some cases do not agree with the reference to them in the Text. In the later issues this has been corrected; but, for the remedy of this oversight, and the convenience of those Subscribers who may possess the first, the discrepancies are noted in the following Errata, which may be bound up with the volume for reference; or the incorrect plates will be exchanged on forwarding the same to the Publisher. To such as have the corrected numbers it will, of course, be unnecessary to say that the Errata will not be required to be added.

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THE

MASON'S, BRICKLAYER'S, PLASTERER'S, AND DECORATOR'S PRACTICAL GUIDE.

INTRODUCTORY REMARKS.

"Art and Literature adorn the memory of a people when their dominion is no more. The fragments of th. beautiful, that lie scattered over a nation's grave, win from eras that follow affection and admiration."

In introducing the highly important Arts of Masonry, Bricklaying, Plastering, and Decoration, we beg to observe at the outset, that it is deemed superfluous to enter at length into their history:—first, because the subject has elsewhere been so fully considered; and secondly, on account of the exclusively practical character of this Work.

We therefore content ourselves by simply dividing the practice of the above arts into three general epochs of architectural development,—viz., *Classic*, *Mediæval*, and *Modern Italian*. The Classic, or *Antique*, comprehends the works of the ancient Greeks and Romans; the Mediæval embraces the productions of the architects of the Middle Ages; and the Modern Italian constitutes what is termed the *Renaissance* manner, being a revival of Roman art, with the peculiar modifications produced by the Italians Brunelleschi, Alberti, Bramante, Michael Angelo, San Gallo, Vignola, Palladio, and their followers in most parts of Europe.

We shall be somewhat sparing in giving examples of the strictly *antique*, believing it to be most useful to dwell profusely upon the two styles which now generally prevail in England,—viz., the Mediæval and the Modern Italian. The former style is, at the present day, almost exclusively adapted for churches, chapels, and schools, and the latter for our streets and secular public buildings, of which the Royal Exchange, the Club-houses, Pall Mall, and the numerous palatial-looking structures that have recently been erected in various streets in the City of London, are examples.

Our principal object, then, is to give a thorough elucidation of the arts named, according to the advanced state of their practice at the present time, and to show clearly the simplest and quickest modes of accomplishing all subjects of difficult construction, by means of the greatly improved systems of geometric lines adopted by intelligent and ingenious practitioners.

We have deemed it advisable, at the commencement of the Work, to abandon the usual hackneyed arrangement of beginning with a long series of geometric definitions, many of which, as generally given, tend to confuse the student in his progress, and are of little practical use, whilst others are so self-evident that it is superfluous to illustrate them at all. We shall consequently confine ourselves to those portions of geometry only that bear directly upon purely architectural subjects, and which occur in daily practice in the construction of buildings. We also deem it necessary to say that we shall make a point of defining certain *false methods* of construction which are sometimes injudiciously employed; and also show erroneous modes of drawing certain figures, *as examples to avoid.* In working out this portion of our plan, we purpose to illustrate geometry in a simplified form throughout the work, and to show its application to special cases, instead of laying down a set of tedious and unnecessary formulæ, as has been the practice of some previous writers on the building arts.

MASONRY, or the art of working and setting stones in building, was carried to a magnificent extent by the Egyptians, Greeks, Romans and Mediævalists, the last people displaying a consummate knowledge of its most recondite and scientific principles, especially in their wonderful vaulting. In that of the Romans, constructive difficulties were carefully avoided; and, notwithstanding the colossal character of their baths, temples, aqueducts, and amphitheatres, we learn from them very little of practical masonry beyond the simplest principles. In our own times, masonry has been variously developed in applying it in novel ways to different requirements. Numerous fortresses, lighthouses, bridges, and docks, of which last, those constructed at London, Liverpool, Great Grimsby, and other places, may be referred to as wonders of the age. Our railways have also fully tested the skill of the modern mason; oblique or *skew* arches, for instance, introduced into this country about thirty years ago, though known for some centuries on the Continent, involving many difficulties in working what is familiarly named the *twist.*

BRICKLAYING, adopted when some objections exist to the use of stone, is a less scientific art than masonry, and involves simpler procedures in finding the lines for the execution of its peculiar ramifications. The Romans used it extensively, even for the richest and most elaborate decorative details,—a practice continued by the Mediævalists and modern Italians, especially in Lombardy, where a fine clay is plentiful, and stone not abundant. In England, in the time of Henry VIII., Holbein extensively adopted ornamental brick-work combined with stone, terra-cotta, and glazed tiles; and we may still see many old houses in which moulded and carved bricks are judiciously introduced. The practice is revived in the present day, on the principle of allowing good materials to show their proper faces, instead of concealing those of the worst description by cement, as began to be done about the time of the late Mr. Nash.

PLASTERING, or the finishing of walls and ceilings with preparations of lime, combined in

various ways with other materials, or with what are called *cements* of different descriptions, is an art which, in its highest branches, necessarily involves much skill in the design and modelling of ornamental details both for internal and external embellishments. We shall illustrate this department somewhat profusely with numerous designs for ceilings, cornices, capitals, panels, friezes, &c.

Decoration (from *decor*, grace) comes within the domain of the artist, and is of two kinds, as relates to surface finish,—viz., that which is produced simply with the aid of colours, and that which has figures in relief, either with or without colours. The former mode has been very successfully practised in this country by Mr. Frederick Sang, Mr. Crace, and especially by Mr. Owen Jones. For decorations in relief, *papier-maché*, *carton pierre*, and various paste compositions are used.

The whole of the above subjects will receive our most serious and careful attention, aided by contributions from some of the most eminent men connected with building operations in London and the country. We thus hope to meet with support from all the classes addressed; and to bring our work to a successful conclusion perfectly satisfactory to the subscribers.

CHAPTER I.

MASONRY.

The Art of Masonry may be divided into three distinct branches, namely,—*Setting*, *Stone-Cutting*, and *Carving*.

The *Setter* is required to be enabled to adjust the various stones that compose a building in their proper positions; he should also be competent to inspect the erection of scaffolding, together with apparatus for the hoisting of his materials, and the fixing of the timber centreings used in supporting arches, domes, vaults, groined roofs, windows, &c. One of his most important duties consists in the construction of sound foundations, on which the superstructure is to rest, errors in this respect often involving the most pernicious consequences, rectified with great difficulty, and sometimes necessitating entire demolition and re-building. For treacherous foundations, *concrete* is usually adopted. A certain description was used by the ancient Romans, and Smeaton derived his first idea of it from the ruins of Corfe Castle, Dorsetshire. Its present extensive introduction is chiefly attributable to the example of Sir Robert Smirke. As now employed, concrete is usually composed of six measures of gravel, or rough stones, mixed with one of lime, what is called *Beton* being composed of limes that set under water, and which are worked up previous to mixture with the other materials. Bedding the footings in cement is another precautionary measure to secure foundations.

PLATE 1 illustrates various operations in setting.

Fig. 1.—Exhibits a false and imperfect mode of building a buttress, as shown by the stones marked A B C D and E, being, so to speak, set on their edges. This example was drawn from an actual work, the stones indicated being in many instances no more than 4 and 4½ inches thick; and it will be observed that, when set up, the centre of the wall was filled with rubble and stone-chippings.

Fig. 2.—Shows the sound and substantial mode of building a buttress, which will be evident on examination.

Fig. 3.—Exhibits a sample of what is called rubble walling in courses; and *Fig.* 4 is a specimen of uncoursed or random rubble walling.

Fig. 5.—Shows stones laid in regular courses and bounded at the angles by quoin stones, the latter of which are rusticated on the faces and have their edges chamfered.

Fig. 6.—The mode of constructing an inverted arch, used to distribute pressure where strength is requisite. The length A B, and the depth of the curve in the centre, from D to C, being given, to find the centre for drawing the curve of the arch, draw the line A C, having first continued the line C D, to an indefinite length, at right angles to the width line A B. Then bisect the line A C at E, and draw a line from E, at right angles to A C. Where this line intersects the continued line C D at F, is the centre for drawing the curve of the arch A C B.

The stones marked E F G H may be of granite or Bramley fall-stone, and the arch itself constructed of brick set in cement, should the strata of the foundation be wet or spongy.

PLATE 1 *a.*—*Fig.* 1.—Simplest form of footings, where stones of a greater superficial area than those employed in building the wall are selected for use as a footing course.

Fig. 2.—Illustrates the effect at side B of not adapting the stones properly in the footings. Side A shows the stones properly bonded; that is, with no joint beyond the face of superstructure.

Fig. 3.—Is the effect of giving the footings too much projection. The weight of superstructure, instead of using the excess, tends to break it off.

Fig. 4.—Where the foundation is bad, the ground ought to be levelled. Half timbers, rough framed, are laid over the whole area, the panels or spaces to be well punned in with earth, and the whole to be covered with good sound planking, preparatory to building on.

Fig. 5.—As above, but with the panels filled in with concrete, which makes a better job.

Fig. 6.—Example where no footings, &c., are required, the building being founded on rock. In this case the bearing surface need only be picked to one uniform level.

Fig. 7.—In soft wet ground, where a larger bearing is required, timber planking may be used advantageously. If it can be kept wet the timber may be used in its natural state, but if subject to alternative wettings and dryings, the timber will require to be prepared.

Fig. 8, 9, 10, and 11.—Show foundations with a judicious development of footings.

Fig. 12.—Where the ground is soft, spongy, and liable to be periodically flooded with water, as most of Westminster, by high spring tides in the Thames, the whole area ought to be covered with a good thick layer of concrete well punned in; and all door or other openings

FIG 1.

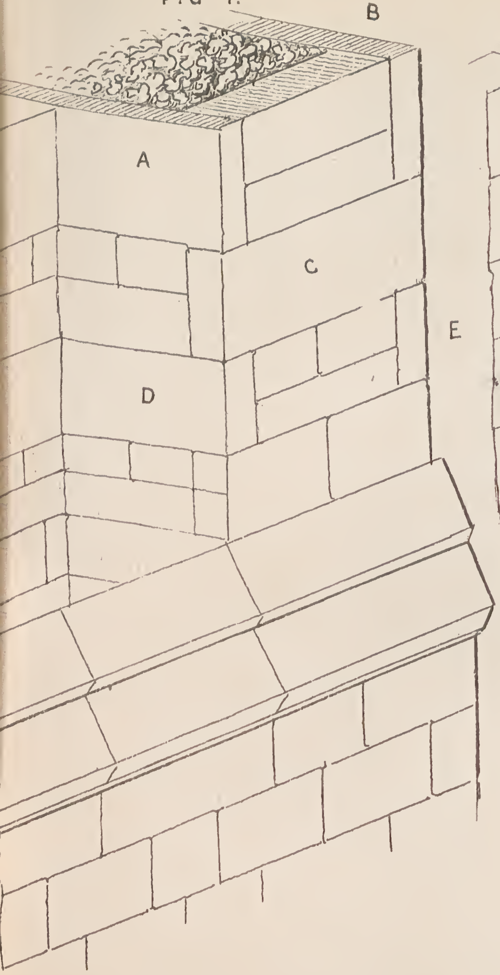


FIG 2.

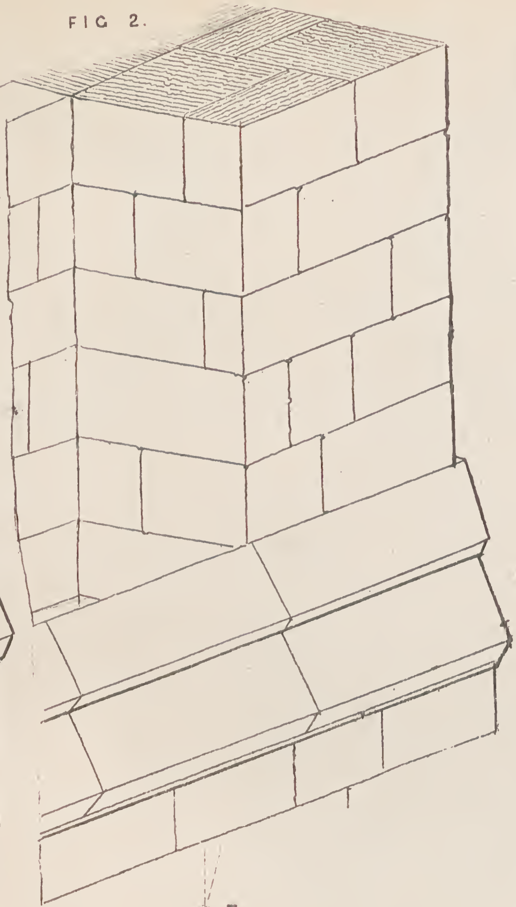


FIG 3.

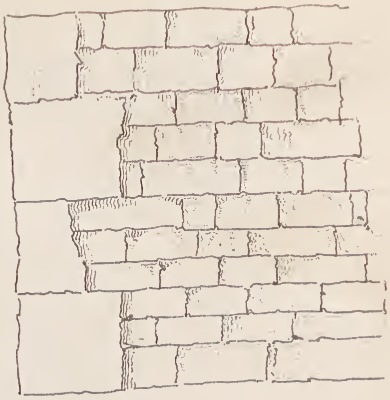


FIG 4.

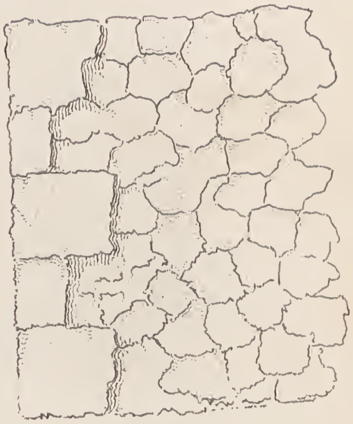


FIG 5.

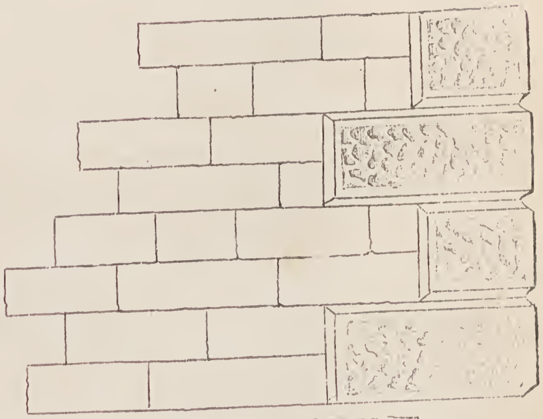
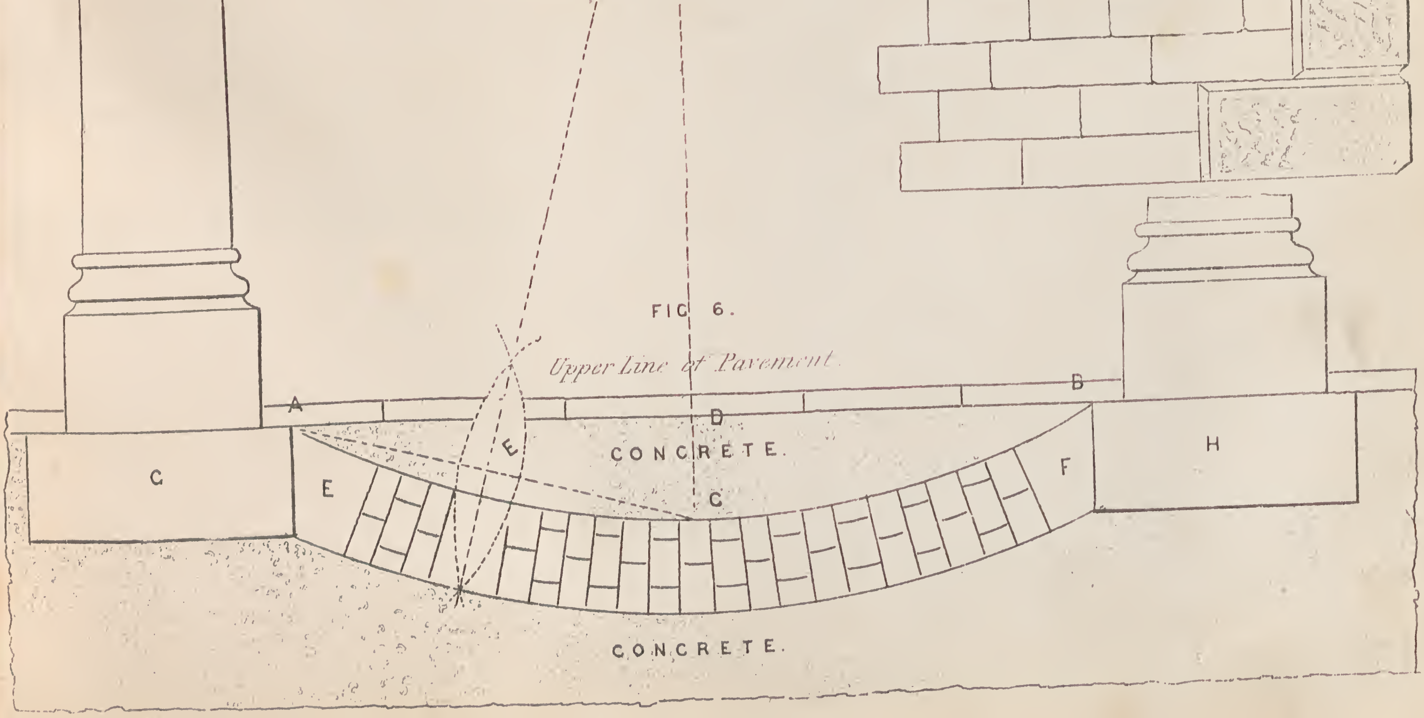
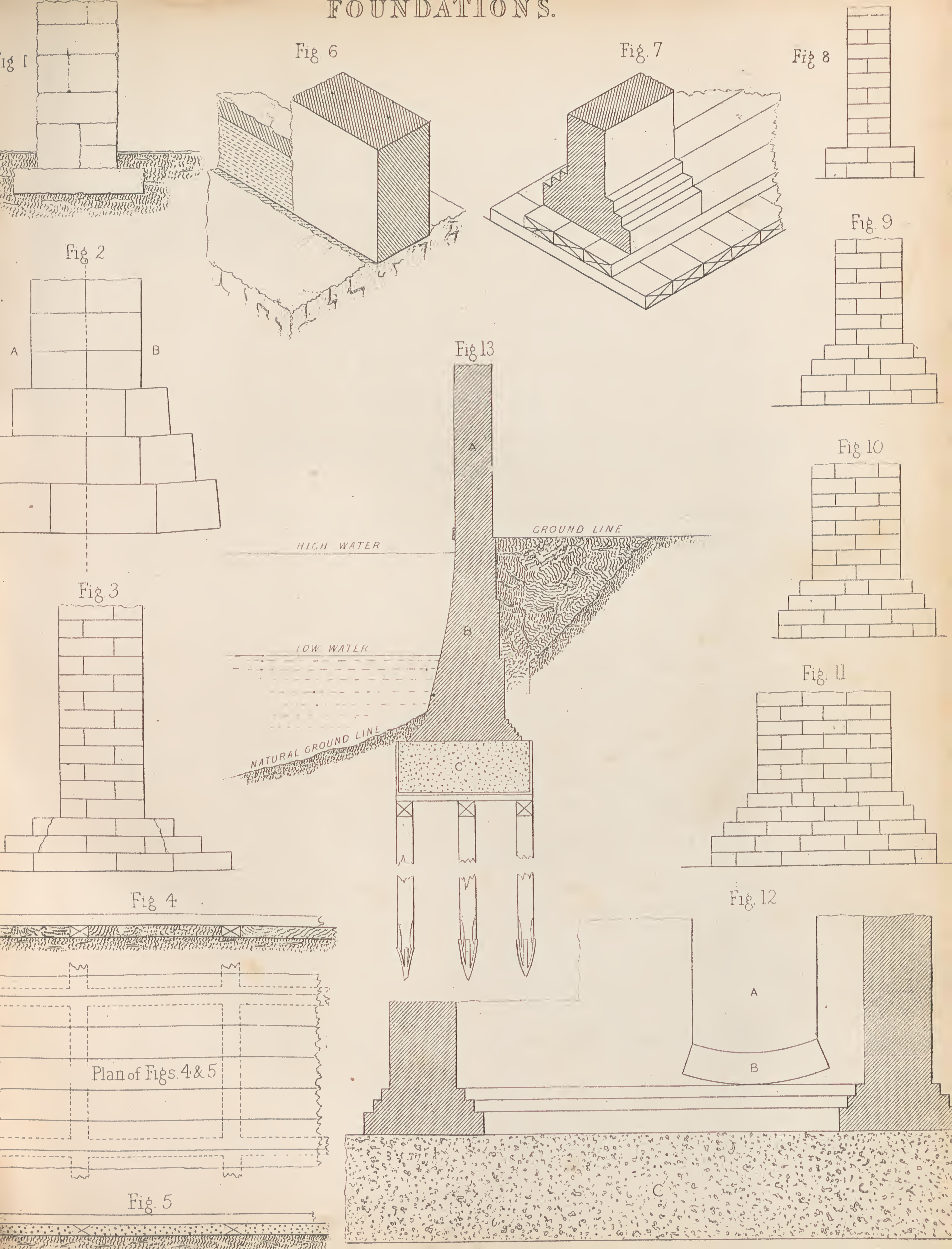


FIG 6.



FOUNDATIONS.



ought to have inverted arches turned beneath them, as shown at A B, and the footing courses continued, not stopped off.

Fig. 13.—Illustrates the use of beton in cast iron cases. In the present instance, a good foundation for warehouses by the sides of tidal rivers would be unattainable by other means, save at a great cost.

CHAPTER II.

THE KINDS AND QUALITIES OF STONE, MARBLE, AND ALABASTER USED IN BUILDINGS.

The principal building stones now in use are granite, both grey and red, Portland stone, Yorkshire sandstones of various descriptions, Dundee sandstone, Craigleith, Darley-dale and Bramley-fall stones (the latter of which is chiefly employed where great strength is required and for hydraulic purposes, as sea and dock-walls, &c.); also Bath stone of several kinds. We may, for the sake of perspicuity, arrange stone into three classes:—1st. Granite; 2nd, Sandstone; and 3rd, Limestone. Of these three classes, for durability and beauty of appearance, more particularly in a polished form, granite carries off the palm, it being generally composed of the three constituents—quartz, mica, and felspar, which are almost indestructible. These ingredients are combined by a cementing power of natural chemical action yet undiscovered by modern science, although we must admit that Mr. Frederick Ra some, in what he terms his silicious stone, has made a very near approximation, and has thus so far rivalled the greatest of all chemists, Nature, in her wonderful and mysterious operations. Next come *sandstones*, of which there are an infinite variety of sorts. Hitherto, until within the last twenty years, the stone from the sandstone quarries, owing to their great distance from London, have scarcely ever been used in our public buildings; and great architects, as Inigo Jones, Wren, Gibbs, Hawksmoor, Chambers, and others, all depended for their supplies from the Island of Portland the consequence being, that the works of those eminent men have all been erected in that material, if we except some of their minor works in the provinces. Portland stone contains 95·2 per cent. of carbonate of lime combined with 1·2 per cent. of carbonate of magnesia, and is destructible when exposed for a length of time to the action of our climate; in fact, when the material has been worked from inferior beds of the quarries, we have known it to decay rapidly within fifty years after it had been employed, and could point to many Portland stone buildings which have been erected within the above period, that are in a deplorable state of disintegration. We are inclined to the opinion that all the best stone in the quarries of the Island of Portland has been worked out, judging from the decay of our modern public buildings,

compared with those of Wren and Gibbs, some of which, particularly those of the latter, as the church of St. Mary-le-Strand, are in a comparatively perfect state.

We must direct the attention of our readers to the important fact, in reference to all buildings constructed of Portland stone, that their elevations which are exposed to a southern aspect decay much sooner than those facing the north, as will be observed on examination of Somerset House, and other buildings in London. This, however, is not confined to Portland stone buildings, nor to any particular climate in which they are situated, for it holds good as applied to all stones in which there is any percentage of lime in their composition. Thus, York Minster, which is built of magnesian limestone, is much more decayed on its southern than its northern facade.

The only remedy that we can at present name for this evil—and it is a very great one—is to saturate the southern fronts of limestone buildings by means of Ransome's patented process, which does not discolour or gum up the pores, and, at the same time, obviates the corrosive action of the atmosphere.

The next stone that has been extensively used in the public and private buildings of the metropolis has been supplied from the quarries in the vicinity of Bath, and bears the universal name of "Bath stone." There are a great many varieties of it, good, bad, and indifferent. Bathstone is generally composed of 94·50 per cent. of carbonate of lime, and 2·50 carbonate of magnesia, and is soft when first quarried, so much so that it can be cut into shapes required by ordinary toothed saws, carpenters' chisels, gouges, and drags, which is not the case with sandstones, the working of which involves much more labour, effected in a great measure by the mason, with his mallet and chisel. The best qualities of Bath stone are those from what are termed the Combe Down, Corsham Down, and Box-hill quarries, the last of which, when well selected, endures remarkably well; and, being of a much softer nature than Portland stone, offers greater facilities for its formation into moulded work and enrichments of various descriptions.

Of other soft stones, we may enumerate the purely magnesian lime combinations, the principal of which come from Mansfield in Nottinghamshire, and Caen, in Normandy. Caen stone is of a beautiful cream colour, close in its texture, and, when well selected, is admirably adapted for internal works, as altars, and reredoses of churches, pulpits, fonts, capitals, &c., where strength is not required. Its fine grain, colour, and facilities of working have induced its application *externally* to buildings, which unfortunately has proved an entire mistake, it having now been indisputably proved that this stone will not resist the climate of England more than fifteen years. Other purely oolite stones have also been tried in some of the modern buildings of the metropolis, all of which have proved more or less unsuccessful; if we except three different qualities from the Mansfield quarries.

Another stone, imported from Aubigny, of the same class is of a still superior quality to that from Caen; but, being much dearer, it has not been brought sufficiently into use to test its resistance to the weather when applied externally. It appears to be something of the hardness and quality of the Portland stone, but much more uniform in its texture, of an agreeable colour, and admirably adapted for monumental and internal works when strength

and precision of finish are required, as it is capable of retaining very fine arrises, and when elaborate carvings are to be executed, an edge may be obtained equal to Sicilian marble.

Of *Sandstones*, unquestionably those from the quarries of Craigleith and Binney hold a most prominent position ; in fact, at present, we know of few stones that will bear comparison with them for density, colour, and durability. They are, however, somewhat expensive, and entail a great amount of labour in the operation of working, the consequence being that they have not as yet been much used in London. A survey around Edinburgh, however, will soon convince any one of the value of these materials for all buildings in which architects aim at permanency and precision of finish in their works. In our enumeration of sandstones, we may include one from Yorkshire that has recently been introduced into the London market, and which has been used with considerable success at the Victoria Patriotic Asylum, Wandsworth Common. This variety is called Hare-hill stone ; it is extremely close in its grain, of a good colour, and particularly adapted for moulded work and carvings of a delicate nature.

Taking the fact into consideration, that most of the public buildings of London have been constructed of Portland stone, our illustrations of the best sandstones produced in the quarries of England, Wales, and Scotland, must necessarily be limited; as almost the only one which has been very extensively recognised in the metropolis for some years is that under the general denomination of "York stone," which is not adapted for ornamental purposes, and not even for the external facings of buildings, it having been, in a great measure, applied only to landings of staircases, and the foot-pavements of our streets; and even for these purposes it is not most judiciously adapted. This limitation arises from its having a most inveterate tendency to laminate, which, singular to state, occurs more apparently on the surfaces of the stone, on which there is no wear or tear. No doubt, taking into consideration the great facilities of transit now brought about by our railway system, by which coal, stone, marble, and other heavy goods can be brought to London at a comparatively small cost, excellent and durable sandstones will be eventually transmitted from the midland and northern counties, where they abound, and will, in time, supersede Portland stone, the quality of which, as we have previously observed, is now considerably deteriorated from the time of the building of the Banquetting House, Whitehall, by Inigo Jones, and St. Paul's Cathedral, by Wren.

Provincial, colonial, and continental traders may complain that we have confined our comments too exclusively to buildings in the metropolis. To this we may reply, that almost all the stones named are found in the provinces; and we deem it unnecessary to extend our observations farther, as economy and sound sense dictate that the materials closest at hand should generally be employed. When the fact is considered that there are no available stone stratas near London,—a city in which such an enormous amount of money is annually expended in building operations,—we trust we are justified in bestowing particular attention on the supply of our modern Babylon with good building stone, which must eventually lead to an enormous increase of commerce, no doubt ultimately rivalling the great coal trade from the midland and northern counties.

On reflecting on the very extraordinary increase of the metropolis in our own time, no one

mistakes of this description, we may point to the equestrian statues of Charles I., at Charing-cross, and George III., in Cockspur-street. The first of these rests on a Portland stone pedestal, designed and carved with consummate skill by the justly famous Grinling Gibbons, but which is now in a hopeless state of decay. The second is certainly a plain, common-place affair, and is fast hastening to a similar condition. On the northern side of Bloomsbury-square, a sedent bronze statue of Charles James Fox is on a granite pedestal, having under it a Portland stone basement; and in Russell-square, we have a similar blunder perpetrated, not to enumerate others of quite as glaring a character, and distinguished by equally inconsistent modes of construction.

After Sicilian, the next marble that comes within our review is that commonly called *Statuary ;* but as this variety is almost exclusively applied to the very highest departments of the sculptural arts, it necessarily carries us, to a certain extent, beyond the province of Masonry proper ; although, when the funds are at command, superior chimney-pieces are executed in it by the ornamental mason. Statuary marble, as found in the quarries of Carrara, is probably the purest limestone in existence. It is of a matchless, snowy-white colour, of remarkably fine and compact texture, and admirably adapted for busts, groups, monuments, the foliage of friezes, and other enrichments, where extreme delicacy of manipulation is required. We have said that this peculiar marble is purely white, but this assertion admits of some qualification : blocks *entirely* free from black or bluish spots, or shades of colour, are only occasionally met with, and command the high price of £3 per cubic foot, the usual prices being, for the best ordinary quality, from 35*s.* to 40*s.*, and for what is termed bastard statuary, from 16*s.* to 18*s.* per foot cube.

What is called *veined* marble is of white ground figured with dark, pencil-tinted veins. This material was formerly a very favourite quality in London, and is still so in many parts of the provinces, being peculiarly adapted for chimney-pieces, table-tops, staircases, linings for walls, pavements of halls, conservatories, &c. Latterly, however, the demand for it in London has greatly diminished, in favour of the so-called Sicilian marble, which we have previously described.

Dove marble is not quite so fine in its texture as veined marble. As its name indicates, it is dark bluish-grey in colour, with light white marks over its surface; or in some instances it has a light-blue ground with faint dark marks or veins.

The above enumeration includes all the varieties that are found in the extensive quarries at Carrara, but in other parts of Italy are met with *Bardilla*, *Sienna*, *Genoa-green*, *Black*, *and Gold*, together with Breccia, which last, however, being so little used, we deem it unnecessary to describe.

Bardilla is a beautiful marble, found at Seravegra, a small town on the frontiers of Tuscany, about six miles from Carrara. It is of a bluish-white ground, with numerous black veins running through it in all directions. This marble is much liked in the country, and it is well adapted for chimney-pieces, which, when of good design and well executed, have a very showy effect.

Sienna is a rich and expensive marble, and in consequence of its high cost is not extensively

Ireland: an exceedingly beautiful green kind from the latter island has recently been converted into columns in the new University Museum erected at Oxford. The Devonshire marble is principally adapted for the small column-shafts in Gothic architecture, and to pulpits and fonts in churches. What is called the Serpentine marble, from Cornwall, is applied to similar purposes, and, when highly polished, its colours are rich, glowing, and brilliant, being alike adapted for the manufacture of small pedestal vases and tazzi, &c., as well as works on a larger scale.

We shall now give a tabular view of the principal kinds of stone, marble, and alabaster, at present used in England, with their prices in London, which, we trust, will be of great use to marble and stone masons, as well as contractors for works in these materials.

TABULAR ENUMERATION OF VARIOUS KINDS OF STONE, MARBLE, AND ALABASTER, USED IN BUILDING OPERATIONS.

	Colour.	Weight per cube foot.	Price per cube foot in London.
GRANITES.			
Aberdeen (Scotch)	Bluish grey	About 185 lbs.	Varying from 2*s.* 6*d.* to 7*s.* according to size of blocks.
Peterhead ditto	Red	„ 185 lbs.	2*s.* 6*d.* to 7*s.*
Cornish	Grey	„ 185 lbs.	2*s.* to 8*s.*
Devonshire	Ditto	„ 185 lbs.	2*s.* to 8*s.*
Leicestershire	Dark red; also green, speckled	„ 190 lbs,	3*s.* 6*d.*
Guernsey	Bluish green	„ 200 lbs.	3*s.* to 7*s.*
SANDSTONES.			
Craigleith (Scotch)	Grey	„ 145 lbs.	3*s.* 6*d.*
Binney ditto	Ditto	„ 145 lbs.	3*s.* 6*d.*
Yorkshire, Hare-hill	Light brown	„ 140 lbs.	2*s.*
Ditto Gazeby	Ditto	14 cube feet to 1 ton when dry	2*s.* 2*d.*
Ditto Park Spring	Ditto	14 ditto ditto	2*s.* 2*d.*
Ditto Bramley-fall	Various warm tints of brown, also light	14 ditto ditto	1*s.* 8*d.*
Ditto Whitley	Of light colour	14 ditto ditto	2*s.*
Ditto Rawdon-hill	Very light brown	14 ditto ditto	2*s.* 2*d.*
Ditto Robin Hood's Bay	Light blue or grey	14 ditto ditto	2*s.* 4*d.*
Ordinary York	Subdued yellow	About 160 lbs.	2*s.* 6*d.*
Derbyshire, Darley Dale	Light brown	„ 148 lbs.	3*s.*
LIMESTONES.			
Portland	Whitish brown	„ 147 lbs.	2*s.* 3*d.*
Aubigny	Pale yellow	16 cube feet to 1 ton.	2*s.*
Caen	Cream	17 ditto ditto	1*s.* 3*d.*
Mansfield, Nottingham	White	About 17 ditto ditto	2*s.*
Ditto ditto	Red	Ditto ditto	2*s.*
Ditto ditto	Yellow	Ditto ditto	3*s.*
Bolsover Moor	Light brown	Weighs 151 lbs. per cube ft.	2*s.*
Anston ditto	Ditto	Ditto ditto	2*s.*
Ketton, Rutlandshire	Brown	About 156 ditto	

	Colour.	Weight per cube foot.	Price per cube foot in London.
BATH STONES, &c.			
Boxhill	Cream	,, 123 lbs.	1*s.* 2*d.*
Coombe down . . .	Ditto	,, 116 lbs.	1*s.* 3*d.*
Farleigh ditto . . .	Ditto	,, 122 lbs.	1*s.* 2*d.*
Corsham ditto . . .	Ditto	,, 122 lbs.	1*s.* 1*d.*
Dundry-hill stone, near Bristol	Light brown	From 16 to 17 cube feet to 1 ton.	1*s.* 8*d.*
MARBLE (*Italian*).			
Statuary, from Carrara	Pure white	. . . . . .	1st quality 35*s.* to 40*s.* 2nd ditto 16*s.* to 18*s.* ditto
		The average weight of all the Carrara Marbles is about 160 lbs., English, per cube foot.	The very finest blocks, purely white, entirely without veins or stains, but seldom found, sometimes realise £3 per cube foot.
Sicilian ditto .	White ground, with slight greyish tints	. . . . . .	7*s.* to 9*s.*
Veined ditto .	White ground, well-figured, with dark pencil tints .	. . . . . .	8*s.* to 10*s.*
Dove ditto .	Dark blue, with light white marks; or pale blue ground, with faint dark marks .	. . . . . .	10*s.* to 12*s.*
Bardilla, from Seravegra	Bluish-white ground, with numerous black veins running in all directions . .	. . . . . .	11*s.* 6*d.* to 16*s.*
Sienna, from Sienna .	A rich yellow colour, with violet veins. This quality is extremely scarce, there being only one quarry where it is found, and is there sold by weight. The more ordinary kind sells at from	Sienna, and other coloured marbles, weight about 180 lbs., English, in each cube foot.	32*s.* to 40*s.*
Green Genoa, from Genoa	. . . .	. . . . . .	28*s.* to 32*s.*
Black and Gold . . .	. . . .	. . . . . .	14*s.* to 18*s.*
MARBLES (*France and Belgium, &c*).			
Griotte	A blood-red coloured marble, profusely spotted with round marks, called partridge-eyes	. . . . . .	31*s.* to 33*s.*
Jeaune Fleuri. . . .	A pale-yellow ground, with exceedingly delicate brown veins, figured with great regularity	. . . . . .	31*s.* to 33*s.*
Vert Morin	A green marble, much the same as the Genoa green previously named . . .	. . . . . .	29*s.* to 32*s.*
St. Anne	Grey ground, mixed with white spots and veins .	. . . . . .	10*s.* to 12*s.*
Rouge Royale . . .	Has a dark-red ground, with white and grey veins, and some brown ones . . .	. . . . . .	11*s.* 6*d.* to 12*s.* 6*d.*
Emperor's Red . . .	This marble is of a pink colour, and when not blotched with whitish and grey-coloured veins, is exceedingly beautiful . .	. . . . . .	14*s.* to 16*s.*

	Colour.	Weight per cube foot.	Price per cube foot in London.
MARBLES (*English, Irish, and Welch*).			
Serpentine (from the Lizard Rocks, Cornwall)	Veined in rich red, green, &c., with bright diallages of brilliant lustres interspersed throughout it .	13 cube feet to 1 ton.	From 10*s.* to 12*s.*
Devonshire	Pure black, and black veined, with white, red, and grey	Ditto ditto	
Derbyshire	Black; also fossilised grey tinged with purple . .	About 14 cube feet to 1 ton.	11*s.* to 13*s.*
Purbeck, nr. Weymouth	Grey and red	Ditto ditto	11*s.* to 15*s.*
Welch	Green	Ditto ditto	Ditto.
Irish	Grey and black	Ditto ditto	Ditto.
Ditto	Green	About 13 ditto	14*s.* to 18*s.*
ALABASTER (*Italian*).			
Tuscany	Pure white	. . . . . .	Sold by weight, 8*s.*, 10*s.*, and 20*s.* per 100 lbs., according to purity of quality.
ALABASTER (*English*).			
Leicestershire, Derbyshire, Lincolnshire, Staffordshire, and Cumberland . . .	White ground, and that from Derbyshire beautifully variegated with red and marone-coloured veins; some of the samples from Leicestershire have also green veins	15 cube feet to 1 ton.	4*s.* 9*d.* in blocks of average size; in blocks of larger dimensions, extra price.

Remarks.—The prices quoted in the foregoing tabular statement are the current rates at the present time at the principal wharves in London for good qualities and for blocks of ordinary size. If blocks of extra dimensions are required, the prices, as a matter of course, will range somewhat higher. There are in the markets inferior qualities at lower rates. The charges for freights from the Italian ports, we should observe, have considerable influence on the prices of different kinds of marble found in Italy; they may, however, be considered very low at present; it is therefore supposed that the minimum rate has been arrived at.

On taking a retrospective review of the foregoing tabular statement, which we commend to the careful perusal of our readers, with the view of erecting a really sound, substantial, and permanent stone structure, we strongly recommend, when the funds at command will allow such expenditure, that the foundations and up to the level of the sills of the first-floor windows of all important edifices, should be executed in the material first on our list, viz., *Granite*, and upon this nearly unperishable sub-stratum we would adapt such stone as has been really proved by experience to be the most durable. This, we admit, is no easy matter to accomplish, as has been unluckily proved in many buildings of comparatively recent date that have been erected in the metropolis, and are now fast hastening to decay.

Upon the subject, Mr. C. H. Smith says that the "precise causes of decay, or of the duration in mineral bodies, such as building-stones, is so complicated, that they often baffle our endeavours to represent them, and their reactions by exact chemical formulæ. It is by

some mysterious process of nature, which we do not at present understand, and cannot generally imitate; nevertheless, the visible distinction between durable and perishable stones may frequently be correctly ascertained if diligently sought after." From the same excellent authority, we also learn that stone may be very porous, consequently very absorbent, and yet extremely durable. "Its durability depends upon the cementing substance, which holds the grains together, being strong enough to resist the chemical and mechanical action of wind, rain, frost, &c."—It should be understood by this statement that Mr. Smith does not mean to infer that absorption is a desirable quality. A stone may, comparatively speaking, be like a sponge, and yet last for ages, without any material decomposition;—"but if two kinds of stone were equal in every other respect, that which soaks up least water will certainly be the most durable."

In reference to the almost perfect durability of some sandstones, we may state a fact, founded on our own experience,—that all those peculiar qualities of the material that imbibe a lichen over their surfaces will last for centuries; this, therefore, is *one* sure guide in cases of selection; but, at the same time, we are bound to confess that we have no positive proof, if the same stone were employed under different atmospheric influences, that the protecting lichen would be generated over its surface. It appears to us as a wise provision of nature that all building stones last longest in the particular localities in which they are found, and that the same quality of stone which stands well externally in one part of England, goes rapidly to decay when fixed in another portion of the island. We may also instance this fact in reference to Caen stone, which lasts comparatively well in Normandy, but when exposed to the atmosphere of London sixteen or seventeen years, as parts of the dressings of buildings, becomes, at the end of that period, in a hopeless state of dilapidation.

As an instance of the successful adaptation of a granite basement and ground floor, we may refer to the Atlas Insurance Offices, at the south-east corner of King-street, Cheapside, which were erected some years ago from the designs of the late Mr. Hopper, Architect; the superstructure of the building is faced with Portland stone, and as yet the whole stands remarkably well, forming, not only a most favourable example of durability, but also an excellent specimen of architectural composition in the Italian style.

Where granite cannot be employed, owing to its somewhat excessive cost, we should recommend the next best stones for the construction of basements, which are Bramley fall, Craigleith, Ketton, some of the Yorkshire sandstones, and Mansfield stones. These qualities have been proved to be exceedingly durable; but in reference to the application of the former to the superstructures of buildings, there are some difficulties to deal with in its adoption, owing to the coarseness of the grain, which, to a certain extent, unfits it for external embellishments when much moulded work and ornament of a delicate nature are required. We are, however, informed that the stratas of the quarries, which offer an unlimited supply, vary very much in fineness of texture, and if the material is well selected it may be used with advantage universally, in which case the basements and superstructures of edifices may be entirely completed of this stone; they would then be of *one* material externally and thus

partially realise the theory of the late Mr. Peter Nicholson, who argued that a really perfect edifice should appear like some of the old Egyptian and Greek temples, as if it were cut from a solid rock.

In this respect, however, we are of opinion that the theory favoured by our late esteemed friend is carried too far; at any rate, it is diametrically opposed to external architectural polychromy, which is now becoming the fashion, in facing many minor buildings with yellow, red, and black bricks, having stone dressings, and inserting various decorated panels in their walls veneered with coloured tiles, and varnished majolica, giving them what one of our most eminent architects has very aptly called a "Tunbridge Wells-ware" appearance. External architectural polychromy is a most difficult matter to accomplish successfully, and only triumphs in the designs of a consummate master of the art. As in literature there is only one step between the sublime and the ridiculous, so in party-coloured architecture there is only one step between harmonious beauty and positive vulgarity. The system may, it is true, be tolerated in small structures, but all conversant with good architecture are aware that the best buildings which have yet been produced—the temples of Egypt, and Greece, and Rome—the cathedrals of the middle ages, as Salisbury, Milan, Chartres, &c.—St. Peter's at Rome, and our own St. Paul's in London, were *all* executed mainly in *one* material, stone or marble, as the case may be. These magnificent remains have commanded the praises of architects and connoisseurs, and the applause of the civilised world. Can we, therefore, do better than follow such glorious examples, and erect our principal structures in one material?

CHAPTER III.

THE VARIOUS KINDS OF ARTIFICIAL STONE.

Having described the different sorts of natural stone, marble, and alabaster now adopted, we proceed to notice what is called "Artificial Stone." Although artificial stone has not yet been used to any large extent for building purposes by being cast or pressed into blocks and built like real stone, it has been, and now is, extensively employed for ornamental works, as armorial bearings, tombs, reredoses, vases, balustrades, copings, &c. There are four principal kinds now in use, viz.:—Coade's, Ransome's, Blashfield's, and Buckwell's Granetic Breccia Stone. The first was invented by the late Mr. Coade, about three quarters of a century ago, and manufactured very extensively by him, in conjunction with Mr. Seeley, at their large establishment in the Belvedere-road, Lambeth. In connexion with this, it is noteworthy that Bacon, the celebrated sculptor, was employed by the proprietors to furnish models of statues and other works to be executed in the

The Silicious Stone has been applied to pavements, balusters, terrace works, vases, and generally for garden decorations; also for ornamental flooring, for halls, churches, and public buildings, and for quoins, cornices, battlements, chimney-shafts, &c. It also possesses one peculiarity and advantage over other artificial stones, which is that lettering can be cut in it with a chisel, rendering it applicable to monumental tablets and works of a similar character.

In reference to *terra-cotta*, we may inform our readers that the literal meaning of the words, as derived from the Italian, is baked earth or clay; and the Roman terra-cottas were made from a particular kind of clay found in great abundance near Rome, on the banks of the river Tiber. The manufacture of works in terra-cotta, however, dates as far back as the time of the ancient Egyptians, who have left behind them numerous specimens of the art in this almost everlasting material. The ancient Greeks and Etruscans carried the art of working in terra-cotta to the highest degree of perfection; and the beautiful forms of vases, cinerary urns, amphoræ, &c., found at Athens, Herculaneum, and Pompeii, have served as models of beauty to the artists of subsequent generations. Of these we shall give some examples under the head of Ornamental Masonry, as our work proceeds; and meanwhile, should any of our readers wish to enter more fully into the subject, we advise them to consult the works of Winckelmann, D'Hancarville, Raoul Rochette, Baptista Passerio, Sir William Hamilton, and Moses, in which will be found excellent specimens, of great use not only to the terra-cotta worker, but also to the intelligent mason who is ambitious of reaching the higher departments of his art.

In modern times Michael Angelo and other great sculptors worked much in terra-cotta, and Bramante and other eminent architects were in the habit of introducing it profusely on the façades of some of their buildings, as may be seen in numerous examples at Rome, Ferrara, Bologna, Venice, Pisa, and Milan. These productions are generally of a pale red colour, and mostly of a sculptural class. They have not been moulded, as is the practice at the present day in England, but no doubt were modelled expressly by the artist, and sent direct to the kiln to be baked.

Holbein, and others also earlier than his time, introduced the material into England, in the reigns of Henry VII. and Henry VIII., during which periods terra-cotta devices in the form of crests, coats of arms, capitals, cornices, chimney-shafts, &c., were executed with a neatness and accuracy of finish quite equal to the most delicate carvings executed in real stone, and assuredly much more durable.

Mr. Blashfield has recently commenced an establishment for the formation of works in terra-cotta, at Stamford in Lincolnshire, and now manufactures from clays found on the estates of the Marquis of Exeter, the Earl of Lindsey, and John Lamby, Esq., and also in Dorsetshire and Devonshire. The Devon clay is used for making terra-cotta in combination with other clays: it is more soapy, and contains a greater quantity of alumina than the clays found in the vicinity of Stamford. The Poole clay is employed in the same manner and for similar works as the Devon clay, principally in the formation of fountains, tazzi, and articles of large diameter.

The general composition of the above important clays is silica, alumina, carbonateof lime, and water, with traces of potash and soda.

On analyzation, the clay from the estate of the Marquis of Exeter, at Wakerley, was found to contain 4·31 per cent. of oxide of iron, which injurious ingredient, however, can easily be precipitated by galvanic electricity. In preparing the clay for use, it is first ground in a mill, after which it is deposited in bins, where it is dissolved in water; it is then removed to what are called the slip-bins, where it is baked or boiled, and is afterwards mixed with pulverised flint, coprolites, fossil bones, or sand, according to the peculiar works required to be made. After the model is formed in the ordinary way, what is termed a waste mould is made over it with plaster of Paris, which mould is filled with a similar material, the process producing the model in plaster. This being effected, a permanent mould is made from the plaster model, into which, when sufficiently seasoned, the terra-cotta is pressed, and, after the various pieces of the mould are removed, the operator commences with modelling tools to clear away the seams of his work, and finish it ready for the kiln, previous to putting it in which the terra-cotta model must be perfectly dry.

It is believed that the late Dr. Buckland, the eminent geologist, was the first who recommended the use of *coprolites* in agricultural chemistry, but it was Mr. Blashfield who first adopted them in the manufacture of terra-cotta, and for which he procured a patent. The object of the invention is the use of minerals or fossils containing phosphate of lime, and known in commerce as coprolites, phosphorites, fossil fæces, and fossil bones, or the remains of extinct animals, in the place of ordinary burnt bones. These fossils or minerals consist chiefly of what geologists term the crag gault, or lias formations of the earth. They generally vary in colour when properly cleansed, from a pale yellow to a dark brown, but the fossil bones are frequently white. By chemical analysis, these minerals or fossils are found to contain from 20 to 60 per cent. of phosphate of lime; the fossil bones, however, have occasionally as much as 70 per cent. of phosphate of lime. The other constituents are chiefly silica, carbonate of lime, alumina, and sometimes small quantities of oxide of iron, iron pyrites, and other substances.

This peculiar terra-cotta, as manufactured by Mr. Blashfield, is adapted for works throughout the whole range of ornamental architecture, as balconies, balustrading, consoles, altars, alto- and bassi-relievi, friezes, candelabra, chimney-shafts, figures, animals, fountains, key-stones for arches, medallions, cantilevers, monuments, bases, tazzi, &c. It is also applicable to works of a plainer description, as water-tabling, and copings for walls and pavements.

Granetic Breccia Stone, the last on our list in the category of what are called artificial stones, is somewhat limited in its application, not being at all adapted for ornamental purposes, being specially applied to basement floors, street pavements, the formation of large water-tanks or reservoirs, aqueducts, roofs, pipes, landings of stairs, lining of fountains, &c. This artificial composition appears to be formed of natural stone core or chippings, combined with Portland cement by hydraulic pressure. In strength it is equal to natural stone, in durability it is said to excel any, and in price will compete with brick-work in some constructions. It can also be worked, coped, and cut, as readily as natural stone, is impermeable to wet, and never vegetates. It can be manufactured in a single piece, of a weight varying from

1 cwt. to 60 tons or more; also in slabs containing from 5 to 100 superficial feet, and can be worked to any contour of plain or moulded face. This peculiar artificial stone is manufactured by Mr. William Buckwell, Phœnix Stone Works, East Greenwich.

CHAPTER IV.

MOULDINGS.

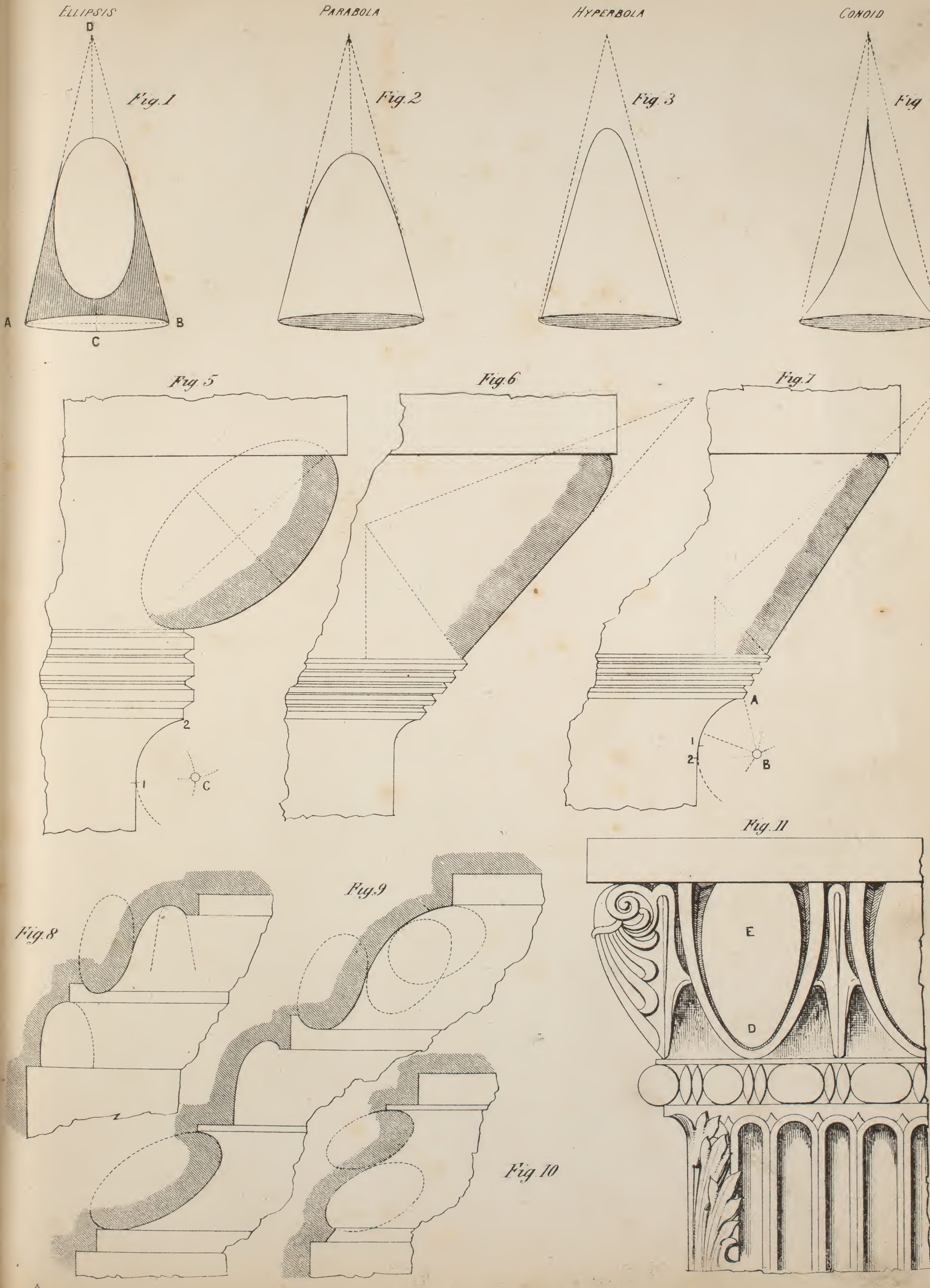
PLATE 2 contains examples of classic mouldings. The Greek architects based their forms upon sections of the cone, and not of the circle, as was the practice of the Romans and their followers in the *Renaissance*, or Revival, period.

Previous to describing the above plate we may remark, that the whole range of mouldings, as applied not only to masonry, but also to joinery, plastering, and every other department of architecture, may be resolved into three elementary forms, viz., the *hollow*, *round*, and *square*. To the ancient Greeks belongs the credit of having invented, or rather greatly-improved mouldings, and brought them to perfection in that particular style which they adopted. The Romans followed, with certain deviations, in which they lost that refinement and variety of outline that so eminently distinguishes many remains of Greek art. After the fall of the Roman Empire, and when what is termed Gothic, or Mediæval, architecture held sway, the architects of the Christian cathedrals blended the Greek and Roman sectional forms of mouldings: hence the variety and boldness of effect produced in the arches, ribs of vaulted roofs, and other portions of their structures, where moulded work is brought into play. Examples of these, together with Roman mouldings, we shall give as we proceed to elucidate this portion of our work, it being of the greatest importance that the practical mason and plasterer in particular should have a perfect idea of the forms he has to work, so that he may be enabled to complete them with accuracy and precision.

Figs. 1, 2, 3, and 4 show the exact form of four cuts from the cone, exhibiting sections employed for architectural purposes. They are the *Ellipsis*, *Parabola*, *Hyperbola*, and *Conoid;* the latter, however, being mostly applied to certain forms of stone roofs, which we shall hereafter describe.

Figs. 5, 6, and 7 are three examples of Greek Doric capitals, showing the application of the ellipse, parabola, and hyperbola, to what is called the echinus of the cap. At A, B, and C are shown the modes of drawing the curves underneath the amulets, at the junction with the shaft of the column; and relative to which the student should bear in mind that, where a curve joins a straight line, there is always an imperfection, which is technically called a "cripple"

GREEK.



inv et del

PLAIN & ORNAMENTAL MASONRY.

SECTIONAL DETAILS OF CORNICES &c. PALLADIAN STYLE.

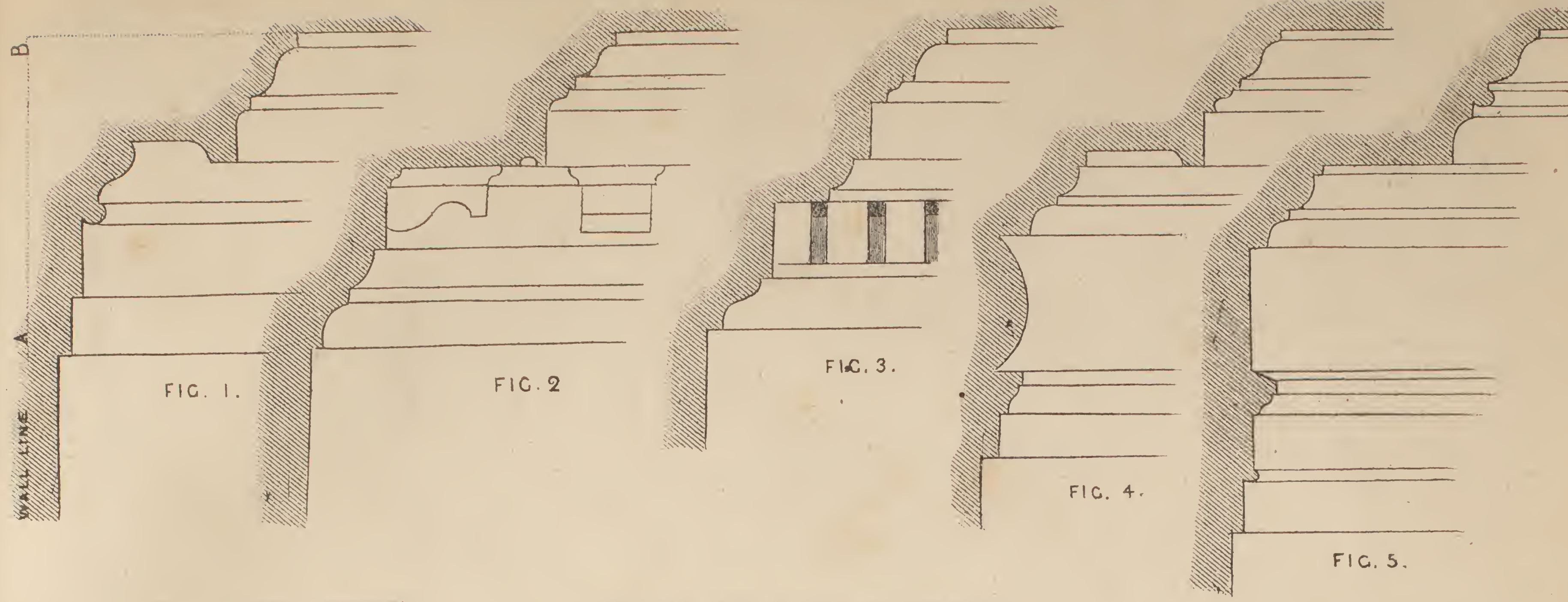


FIG. 1. FIG. 2 FIG. 3. FIG. 4. FIG. 5.

ENRICHED MOULDINGS & CORNICES.

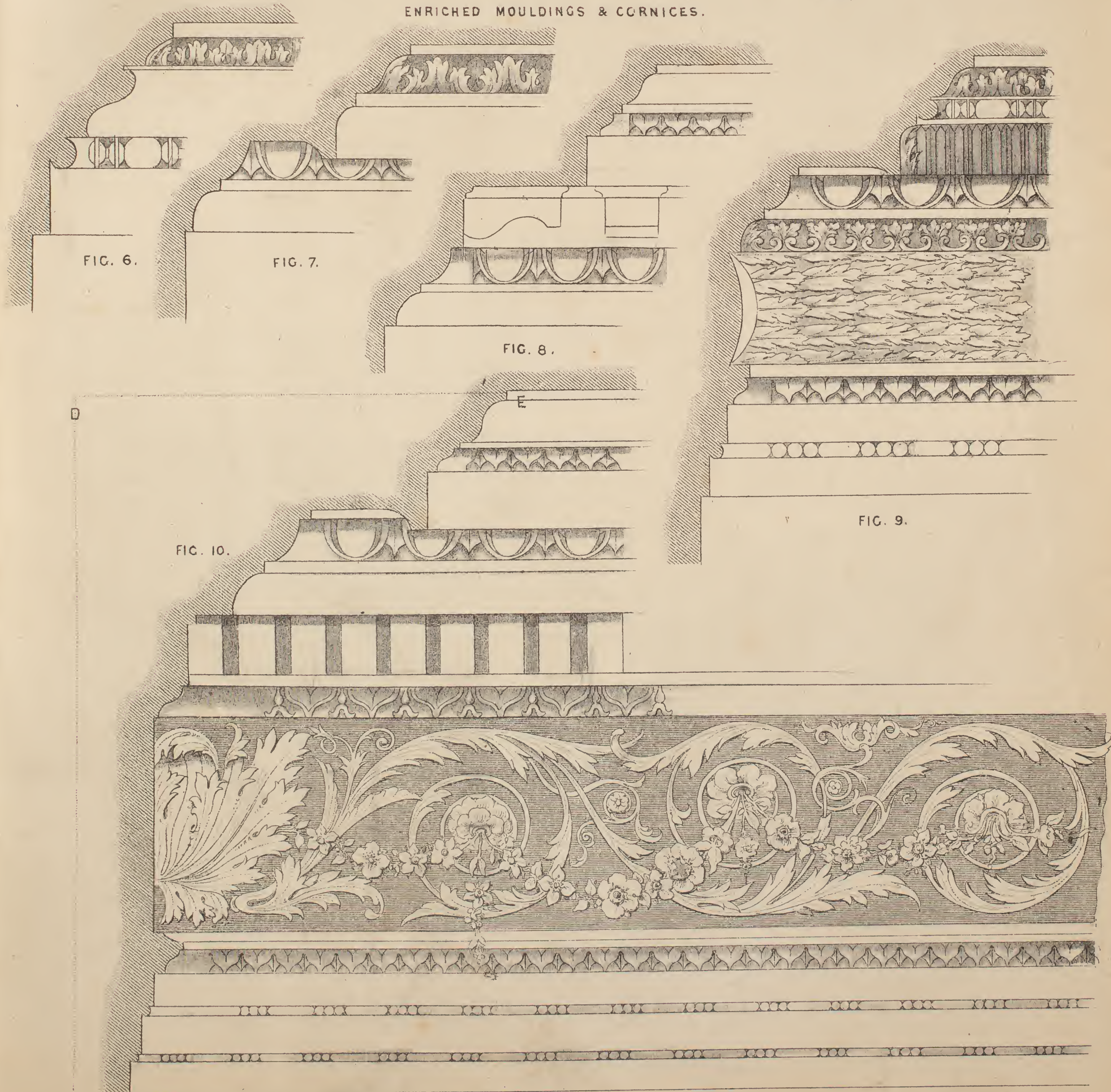


FIG. 6. FIG. 7. FIG. 8. FIG. 9. FIG. 10.

London James Hagger 67 Paternoster Row

when almost exclusively used, there is a predominance of shadow, unpleasing to many persons. A blending of the two systems is most proper for the climate and requirements of this country.

CHAPTER V.

ON ARCHES.

An arch in building is a judicious arrangement of stone or bricks in a curved form, by which their weight and mutual compression produces an equalised pressure, so that they not only support each other, but, by their peculiar mode of arrangement, may be made to sustain an enormous weight.

Properly constructed, an arch does not depend on the cement or mortar between the stones or bricks of which it is composed; for the various parts should be so arranged with such accurate skill and geometric knowledge as to be independent of extraneous aid.

It has been affirmed that the pediments of the ancient Greeks first suggested the idea of the arch, as when two rafters are placed opposite one another, they will, by the pressure at the apex and the bases, afford mutual support. The Romans, again, were long supposed to be the inventors of arched construction. Historical research has, however, dissipated the above conclusions. Sir Gardner Wilkinson has shown that arches were used in Egyptian tombs three thousand four hundred years ago, and Layard has pointed out their adoption in Nineveh. It is probable that the Greeks were not unacquainted with the principle of the arch: its mere form, whether round or pointed, must, of course, have been known to every student of Euclid. But the severely horizontal character of the architecture of the Greeks, like that of the Egyptians, would in itself preclude the adoption of a feature so opposed to the *repose*, which seems to have been a principal aim. Again, the stability and eternal duration which the Egyptians desired, was probably another motive which induced them to prefer *lintelled* to *arched* construction; and, in proof of the correctness of such views, we observe that their temples bid fair to endure long after the mediæval cathedrals are destroyed

by the thrusting and racking of the parts of the complicated vaulting, pressing in all directions, and ultimately accelerating its own ruin.

The Romans were unquestionably the first people to introduce the extensive use of the arch, not only as a constructive but also as a decorative feature; and the dome of the Pantheon, and the vaulting of the Temple of Peace, and of the Baths of Caracalla and Diocletian, still excite admiration. There is, however, little or no evidence that the more recondite principles of constructing arches were at all apprehended. It was reserved for the mediæval architects of Europe to mature the *science* of stone-cutting. Vaulting was carried by them to a truly wonderful extent; and there is doubtless more constructive and geometrical skill displayed in one or two of the Gothic cathedrals than in the aggregate productions of the Romans. On the revival of classic architecture in Italy, many admirable examples of arching were produced; and we scarcely need name the dome of Santa Maria, at Florence, and that of St. Peter's, at Rome.

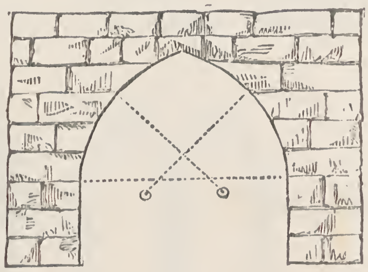
Turning next to the principles of constructing arches, the late Dr. Hooke contended that the figure into which a flexible cord or chain arranges itself when suspended freely from two extremities is the proper form for an arch composed of stones of uniform weight. This *catenary curve*, as it is called, had, however, long before been proposed by Galileo as the correct form of an arch in equilibrium. We do not pretend to decide on the absolute correctness of the theory; but it is certain that such arches have rarely been adopted by practical men; and Sir Christopher Wren, one of our most scientific architects, had no faith in their superiority. His arched construction is not, however, always commendable, as, for instance, the elliptical arch of Temple-bar, in which the joints were not set out from their proper centres; hence the crushing observable at the haunches.

One of the great principles that ought to be carefully studied in designing arches is, that the longer the joints of the voussoirs the greater the strength will be. Consequently it is of the greatest importance that the voussoirs should always be as long as special cases will admit. It is quite evident that the old Gothic architects were well aware of this fact; for in the construction of their vaulted roofs they introduced what are technically called ribs, adopted in many cases both diagonally and at right angles. These ribs, which we shall subsequently explain, give an additional depth to the general vaulting of the roof, and thus materially augment the strength of support required for the spandrils that come between the ribs.

As an instance of the advisability of this mode of procedure, we could point to several instances in bridge building by the mediæval masons, where similar systems have been adopted. One very prominent is Framwellgate Bridge, built over the river Wear, in the city of Durham, in the time of Bishop Flamburg. It has now stood several centuries without showing any signs of shrinkage.

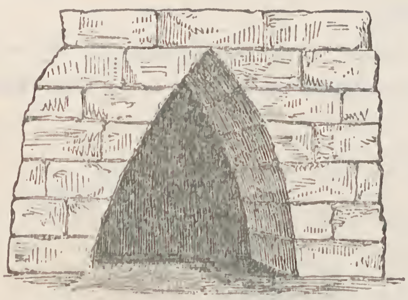
In the case to which we advert, ribs are formed under the soffite or intrados of the arch, and thus not only give extra strength, but also add to the picturesque beauty of the structure by giving a variety of lines to the under-side of the arch, which, as a general rule, is kept perfectly plain. In designing and constructing the arches of bridges, we therefore confidently recommend this peculiar mode, as offering both economical and artistic advantages,

in addition to extra strength. As the arches of bridges, however, according to present practice in England, come more immediately within the domain of the civil engineer, we shall go more fully into this section of the subject under the head of "Engineering Masonry."



In reference to the history of arches, Mr. Fergusson observes that "the so-called treasuries of Mycenæ and Orchomenos, as well as the chambers in Etruscan tombs, prove that as early as ten or twelve centuries before Christ, the Pelasgic races had learned the art of roofing circular and rectangular chambers with stone vaults, not constructed, it is true, as we construct them, with radiating voussoirs, but by successive layers of stones, and closed by one large stone at the apex; the joints of the stones all running parallel," as shewn by the accompanying diagram.

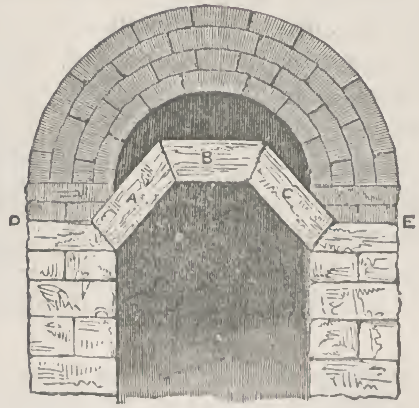
We may also instance an example shewing that the Etruscans carried out the form of the pointed arch by *horizontal* joints, illustrated by the adjoining cut, which is taken from the gateway at Arpino. They also used the *radiating* arch to a great extent, which they



formed by deep-moulded voussoirs, and which, probably, gave the Romans their ideas of vaulting of a similar character, carried out subsequently on a more comprehensive and magnificent scale.

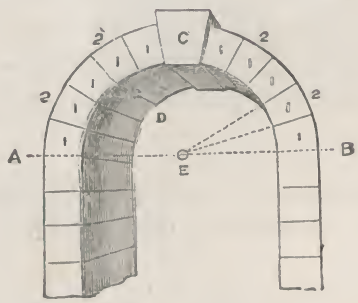
Before leaving the history of arched construction, we may mention an instructive example in a tomb discovered near the pyramids of Gizeh, by Col. Campbell, which exhibits the primitive form of an arch, composed of three stones only, above which is another of regular construction in four courses of voussoirs, as shewn at page 24. In reference to this peculiar remain, we may remark that the introduction of the key-stone B has a disadvantage to a certain extent, inasmuch that it acts like a wedge, and has a tendency to thrust the two lateral stones A and C out of position. As Mr. Fergusson justly observes :—"This disadvantage and difficulty has been felt by architects of all ages and in all countries; still the advantage of covering large spaces with small stones or bricks is so great, that many have been willing to run the risk, and all the ingenuity of the Gothic architects of the middle ages was applied to overcoming the difficulty." We are inclined to the supposition that all the

work above the lines D E has been built at a subsequent period to the arch A B C as a



means of protecting it. This arch of three stones may be considered as one of the most primitive specimens in existence.

The simplest curved radiating arch is that formed by a semicircle, A B being the springing line, and the wedge-shaped stones, 1, 1, 1, &c., what are technically called the

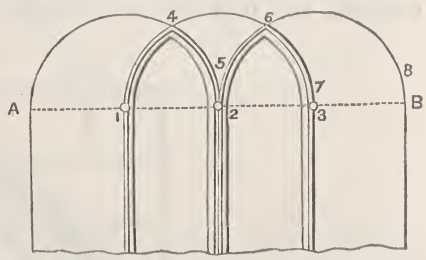


voussoirs. D, the under side of the arch, is called the soffit, or *intrados*, and 2, 2, 2, 2, the *extrados*, or outer line of the voussoirs. C is the key-stone, and E the centre from whence the arch is described, from which centre, as will be seen, all the joints of the arch stones, 1, 1, 1, &c., must radiate to the extent of the circumference, 2, 2, 2, 2, the extrados line. Such are the elementary principles of the radiating arch.

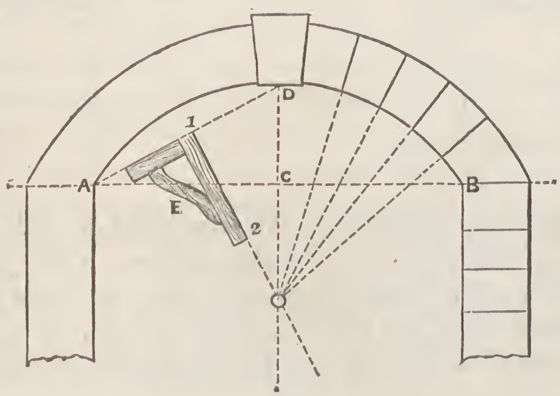
The various forms and ramifications of the arch are of an almost endless description, and as practised in various countries, form a most interesting subject for investigation; but, as the purpose of our work is chiefly of a practical nature, we do not deem it necessary

to burden our pages profusely with historical matter on the subject, but merely observe that the arch has appeared in numerous conformations, not only in Italy, but also in Egypt, Assyria, China, Hindostan, Persia, Arabia, Spain, France, Germany, and England. To the mediæval architects, however, we are indebted for its most comprehensive development, as applied not only to portals, doorways, and windows, but also to the groined vaultings of roofs, &c.

The mediæval architects probably derived the idea of the pointed arch from the intersection of two or more semicircles, as shewn by the annexed diagram: A B is the general springing line, and 1 2 3 the centres of the three semicircles, A 4 5, 1 4 6 7, and 5 6 8 B, by the intersection of which the two pointed arches shewn by the triple lines are formed.



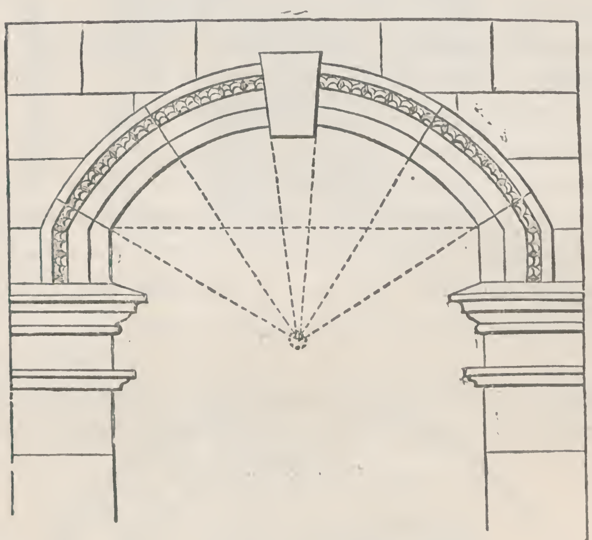
Next to the circular arch previously described, that which is least complex in its formation is called the segmental arch, its curve being the segment of a circle, the mode of generating which is shewn in the diagram underneath. The width A B, and the rise from the base line to the soffit (viz. C D) being given:—First



draw the tangent line, A D, which bisect at the point 1. Then continue the line D C to an indefinite length, at right angles to the springing line A B. This being done, the workman must place his set-square E at right angles to the line A D, at the central point 1, which gives the line 1, 2; that being continued until it intersects the line C D at O, gives the centre from whence the segmental curve of the arch is drawn, and also the point from which all the joints of the voussoir stones must radiate. We have illustrated the practical application of this particular arch, as applied in an inverted form to foundations, at plate 1, under the head of "Constructive Masonry."

The segmental arch was used to a certain extent by some of the Italian architects, in

what is called a "*stilted*" form, as shewn on this page. This mode has also been adopted by several architects of our own time; but it appears to us devoid of elegance, and has an apparent want of constructive stability that precludes its general adoption. This peculiar arch, it would almost appear, formed the stepping-stone to one much more picturesque in outline and more difficult of execution, which is called the elliptical arch, much used for bridges of large span, and the openings of wide gateways, for which it is admirably adapted, not only for its strength when properly constructed, but also for the graceful

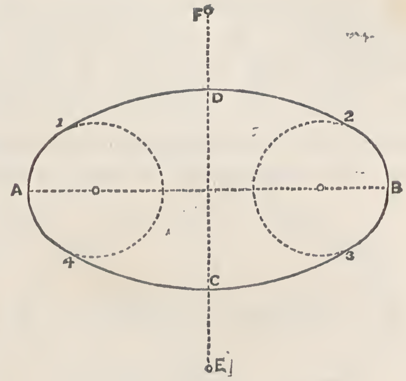


curvature of its intrados. For examples of this description of arch we advise the student to examine Blackfriars, Waterloo, and London bridges, which, for beauty of design, largeness of span, and excellent materials, probably have no rivals in Europe. The first is constructed of Craigleith stone, and the last of grey granite. The jointing of the stone-work of Blackfriars bridge is one of the best specimens of this kind of masonry in London.

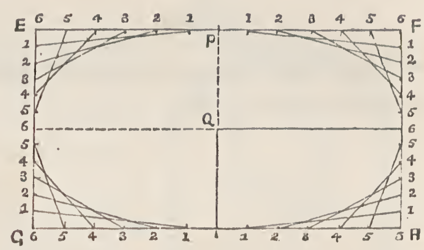
We shall now proceed to explain various modes of describing ellipses. At the outset we may observe that, as the *true ellipsis* is derived from a *diagonal* cut through the cone or cylinder, no portion of its curve, strictly speaking, is any part of a circle: it cannot, therefore, be drawn correctly either by the compasses or from centres. We have illustrated the various sections of the cone, including with the ellipsis the parabola, hyperbola, and conoid, on plate 2, under the head of "The Theory of Mouldings," to which we refer our readers.

The most pleasing proportion for the elliptical arch, is to make the height equal to one-third of the width, although the height is generally determined by particular circumstances to suit special situations and requirements.

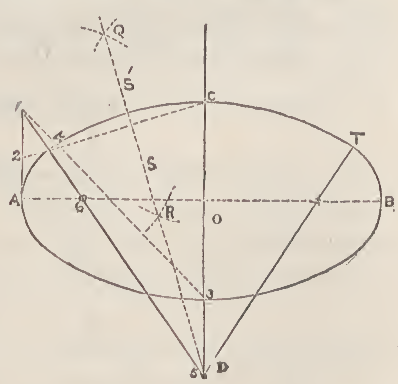
The adjoining woodcut shews the mode of drawing the ellipsis by the compasses, which, on inspection, will be found very defective. The central line, A B, is called the *conjugate*, and C D the *transverse* axis of the figure. The faults of this conformation are:—firstly, it is too full at the ends; and secondly, it is what is technically termed "*crippled*" at the junction of the small and large curves at the points 1, 2, 3, 4. E and F are the centres for drawing the segments 1 2 and 3 4. This example is given as an operation of forming a compounded figure of ungraceful outline to be specially avoided.



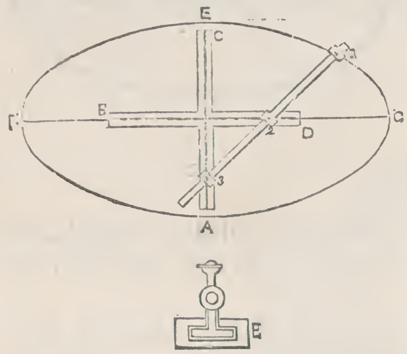
The next diagram is a method of describing what is commonly called an ellipsis, but which is really not so, although it is a much nearer approximation to the true form than that above. This mode has hitherto been almost universally used by carpenters, as being readily accomplished, the operator having no centres to find for the curves, and it can be drawn to any given size, however large, with great facility. As will be observed, the *modus operandi* employed is by intersection of lines. The transverse and conjugate axes being given, surround the space by the parallelogram E F G H. Then proceed with the quarter enclosed within E P Q O, and divide the bounding lines O E and E P, each into six equal parts. Draw the lines 1 1, 2 2, 3 3, 4 4, and 5 5; and, at the points where they intersect, stick pins or brads; round these bend a thin rod, which, followed by the pencil, gives the curve of one quarter of the figure. Repeat the process at the three other quarters, and the problem will be completed. Although the half of this figure is not really a semi-ellipsis, it forms by no means an unpleasing arch.



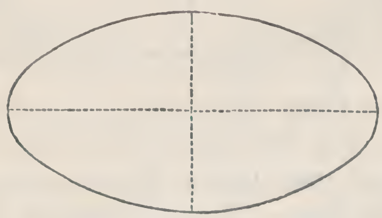
The adjoining mode is probably the closest approximation that can be arrived at in shewing the true ellipsis by the compasses or from centres. It was, we believe, invented by the late Mr. Peter Nicholson. To draw it, erect the perpendicular line A 1 at right angles to the conjugate axis A B, and make it equal to O C. Divide A 1 into two equal parts, and draw the dotted lines 2 C and 1 3. Then, from the centre C and the centre 4, at the intersection of 2 C and 1 3, describe the arcs Q R. Draw the line S S, until it cuts the continued transverse axis at D, this being the centre of the larger curve of the ellipse 4 C T. Next draw the line 1 D, and where it cuts the conjugate axis at 6, is the centre of the end curves of the figure.



The foregoing is probably the most ingenious mode of drawing the ellipsis by the compasses or by centres that has yet been discovered. We may, however, here remark that the really true form of the ellipsis can only be derived from the diagonal cut from the cone or the cylinder, as we have previously observed; and the next nearest approximation to the curve must be obtained by *continued motion.* For this purpose, we know no other instrument so well adapted for effecting the purpose than the trammel, of



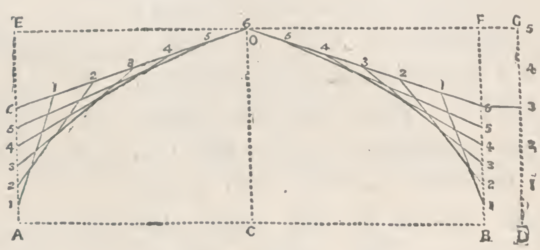
which we add a diagram. The trammel is an exceedingly useful instrument, and may be made either of wood or brass. It consists of a cross, as shewn at A B C D, in which is formed a groove. In this groove the rod 1 2 3 works by means of two sliding nuts at 2 3. Make the distance from 2 to 1 half the shortest diameter of the ellipse A E; and from the nut 1 to 3 equal to half the longest diameter F G. The points 2 and 3 being put into the grooves, then move the rod round, having a pencil fitted in it at 1, which will give the curve of the figure. E shews the section of the cross and rod of the trammel more at large.



The next diagram is the exact form of the true ellipsis as cut from the cone.

The three arches following are applied to Gothic architecture in that period of its development called Domestic Tudor, and are principally applied to porches, doorways, windows, entrance halls, and corridors; also to the groined vaults of roofs. The first is founded on the ellipsis, the second on the parabola, and the third on the hyperbola. To find their proportions, and the mode of drawing them, the base lines A B, and the heights C O, being given:—

In the first, form the rectangle A B E F, and divide its height at D G into five equal parts. Set three of these parts on the line D G, beginning from the base D, and draw the line 6 O. This done, divide the lines B 6 and 6 O eachin to six equal parts; after which, rule the

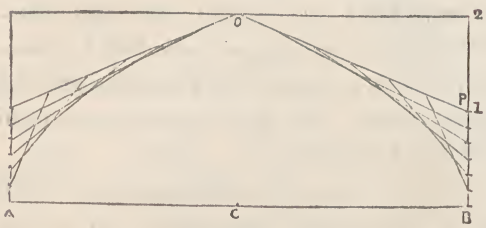


Elliptical.

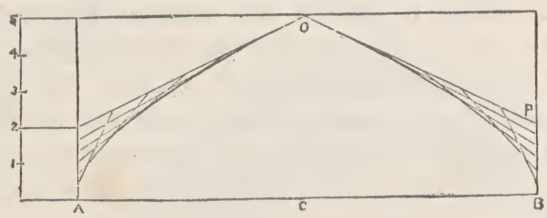
lines 1 1, 2 2, 3 3, 4 4, and 5 5, the intersections of which give the points, on which pins

must be stuck; round these a thin lath must be bent, that gives the curve of one side of the arch. Repeat a similar operation on the other side, and the soffit line of the arch is completed.

The same process must be observed in the accompanying parabolic and hyperbolic

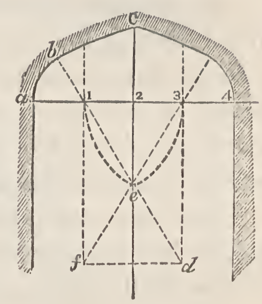


Parabolic.



Hyperbolic.

arches; but it will be perceived that the proportions are different. In the former the height, as shewn, must be divided into two parts; and in the latter into five, taking two of the divisions, viz. 1 2, for the line P O.



The next figure illustrates the mode of describing the usual four-centred Tudor arch, which is generally adopted as a very graceful form. Set off a 4 equal to the width of the arch, and divide it into four parts, at *a* 1, 1 2, 2 3, and 3 4. Then, with 1 3 as a radius on the points 1 and 3, describe the arcs 1 *e* and 3 *e*. Draw lines through 1 *e* and 3 *e*, after which, rule perpendicular lines through 1 and 3, cutting the lines 1 *e* and 3 *e* in *d* and *f*. This done, with 1 *a* as a radius on the point 1, describe the arc *a b*; then with the radius *b d*, draw the remainder of the arch *b c*. The other side of the arch is completed by a similar process.

The ancient Romans have, without doubt, as we have previously indicated, the credit of being the first people who applied the invention of the arch to bridges, aqueducts, and triumphal arches, amongst the last of which we may enumerate, as the most remarkable, those of the Emperors Titus, Septimus Severus, and Constantine.

The bridges of ancient Rome were about eight in number, but none of them were distinguished by the great width of their arches, and will bear no comparison with similar works that have been erected in our own time; however, they serve to show the elementary principles of such constructions, and were the precursors of succeeding essays in arched masonry of superior description.

We find that the span or chord of the Roman bridges seldom exceeds eighty feet, and their versed sine, or height, was nearly half the chord, thus being nearly semicircular in form; yet, notwithstanding their comparative smallness, like most of the works of the Romans, they are well worthy of observation and careful study, for their constructive qualities and also for their general excellence and durability.

Subsequent to the fall of the Roman empire, the followers of Mahomet, who spread themselves more or less over Syria, Persia, Africa, Spain, and Sicily, carried the arch to great perfection, as many notable examples now remaining clearly shew, more particularly in Spain,

where the Moors rivalled the best arched constructions of Rome. Amongst their successful works, we may name the bridge over the Guadalquiver.

In reference also to the application of the arch to bridge-building, we may state that the bridge over the Rhone at Avignon is one of the most ancient examples in modern Europe. According to Gautier, this structure was projected and built by Benezet, and was commenced in 1176, the same year in which Peter of Colechurch was engaged upon Old London-bridge, which was completed in 1188. The Avignon bridge consisted of 18 arches, and the length of the chord of the greatest arch was 110 feet 9 inches. Its curve was the segment of a circle, and the height of its voussoirs at the vertex 2 feet 3 inches.

Since this period, however, the construction of large arches has been practised with great certainty; and we feel confident that an arch of 200 feet in span, having 20 feet for its versed sine, may be built with the greatest degree of accuracy and stability. However, it should be borne in mind, in reference to attempting extremes in arch-building, that the voussoirs, as we have previously observed, must be taken into careful consideration, otherwise failure will ensue.

By comparing Waterloo-bridge with that of Avignon, just adverted to, we may state that it is 1,250 feet in length, and consists of 9 elliptical arches, each of 120 feet span, the versed sine of them being 32 feet, and the length of the voussoirs at the vertex 5 feet. Waterloo bridge is entirely of grey granite, was designed by Ralph Dodd, and executed under the direction of the late Mr. Rennie. It is probably the only bridge in which a perfect level surface is maintained throughout the entire roadway and footpaths.

The most ancient bridge in Great Britain is that of Croyland, in Lincolnshire, which is said to have been built in the year 860. It has three distinct approaches, from as many roads, formed by the three segments of a circle that meet in the middle and form pointed arches.

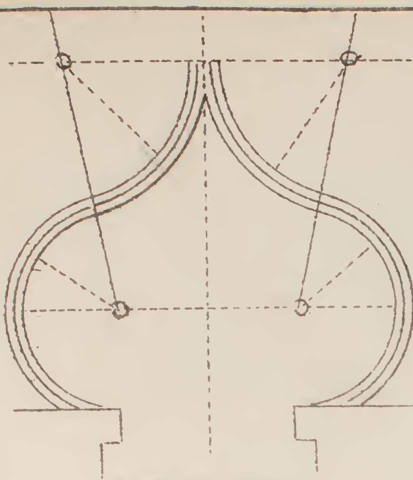
The longest arched bridge in this country is that over the river Trent, at Burton, in Staffordshire, built of squared freestone. This peculiar structure consists of 34 arches, and is 1545 feet in length.

Of bridges having what we may term single arches for the water-way, and where the centre arch much exceeds the minor arches at the sides in span, we may name one over the Canal, in Blenheim Park, Oxfordshire, designed by Sir John Vanbrugh, and another over the river Tees, at Winstone, in Yorkshire, from a design by Sir John Robinson. The former of these has a chord line of 101 feet, which is 5 feet more than the far-famed bridge of the Rialto, at Venice. The latter has a span of 108 feet 9 inches. They are both formed of the segments of circles, and well worthy of the attention of practical masons.

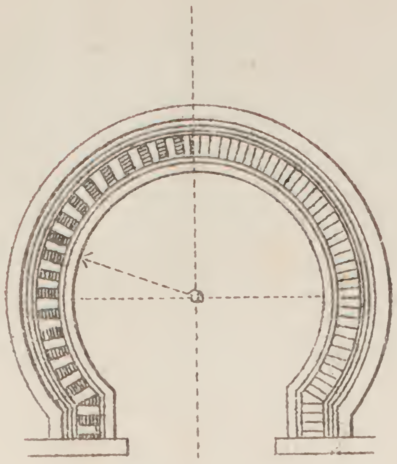
According to Mr. John Henry Parker, of Oxford, who is an excellent authority on everything appertaining to Gothic architecture, "the earliest examples of the pointed arch in England, of which the dates can be satisfactorily ascertained, appear to be the church of Kirkstall, begun A.D. 1152, and Lanercost Priory, dedicated 1169." From these many follow in rapid succession, as, for example, the circular part of the Temple Church, London, which was dedicated in 1185, and the choir of Canterbury Cathedral, rebuilt in 1175.

To give our readers a more general and comprehensive idea of the various forms of arches

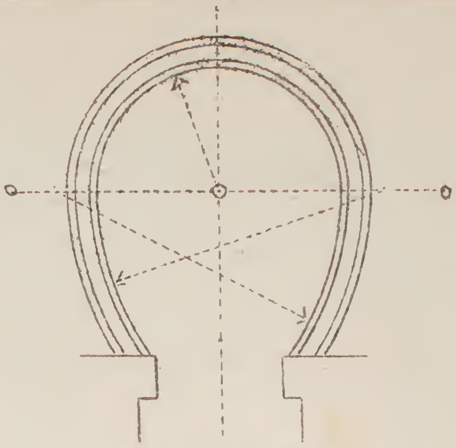
ARCHES.



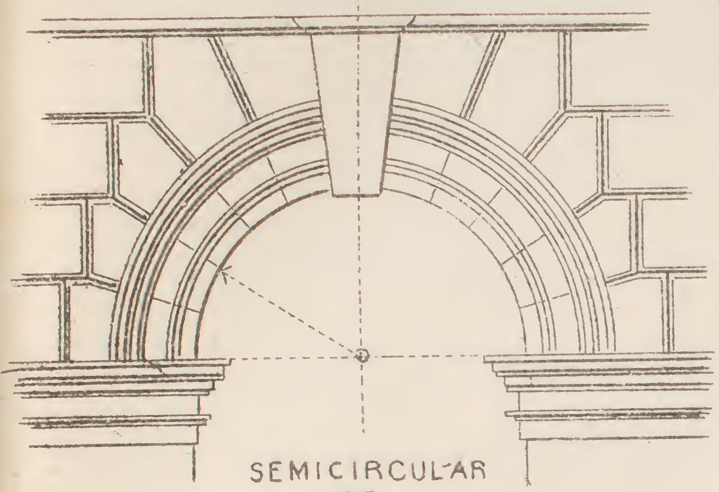
ARABIAN ARCH.
FIG. 1.



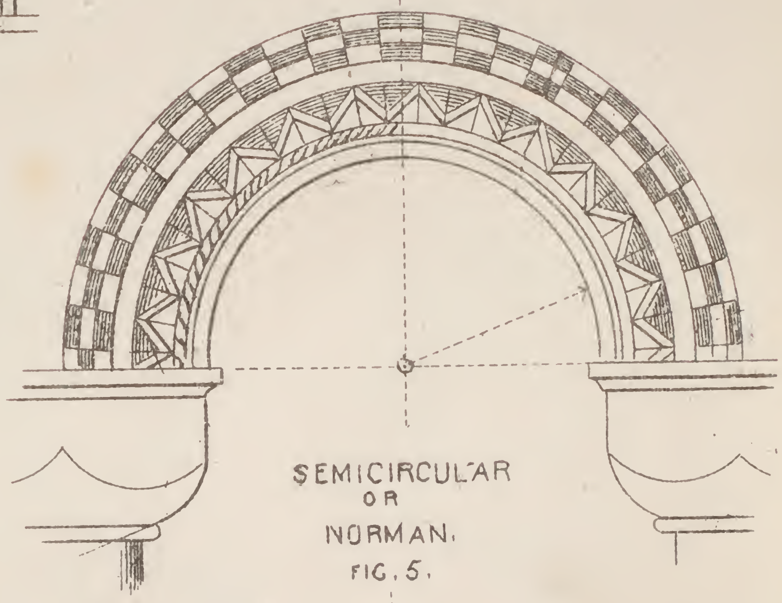
HORSE SHOE
OR
SARACENIC.
FIG. 2



ARABIAN ARCH.
FIG. 3.



SEMICIRCULAR
OR
ROMAN.
FIG. 4.



SEMICIRCULAR
OR
NORMAN.
FIG. 5.

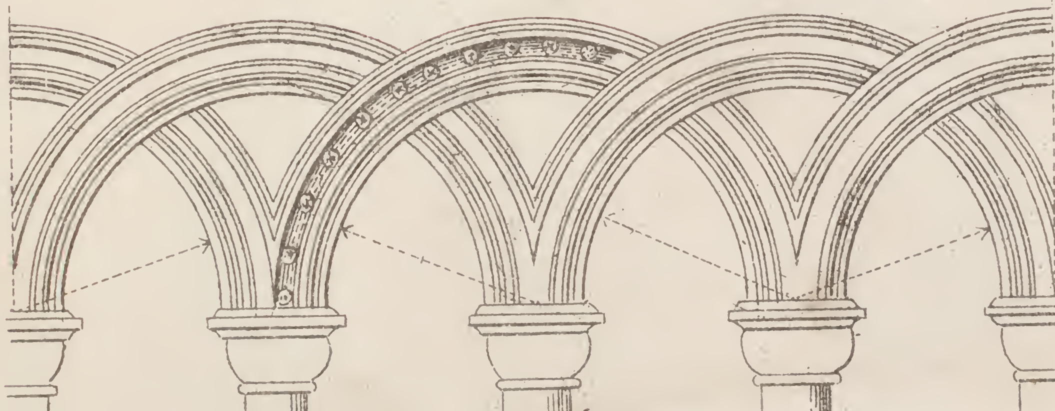
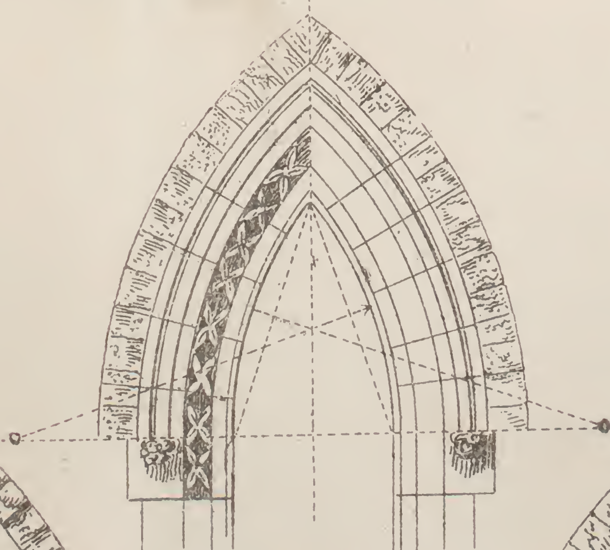


FIG. 6

SUPPOSED ORIGIN OF THE POINTED ARCH.



LANCET
OR
EARLY ENGLISH.
FIG. 7.

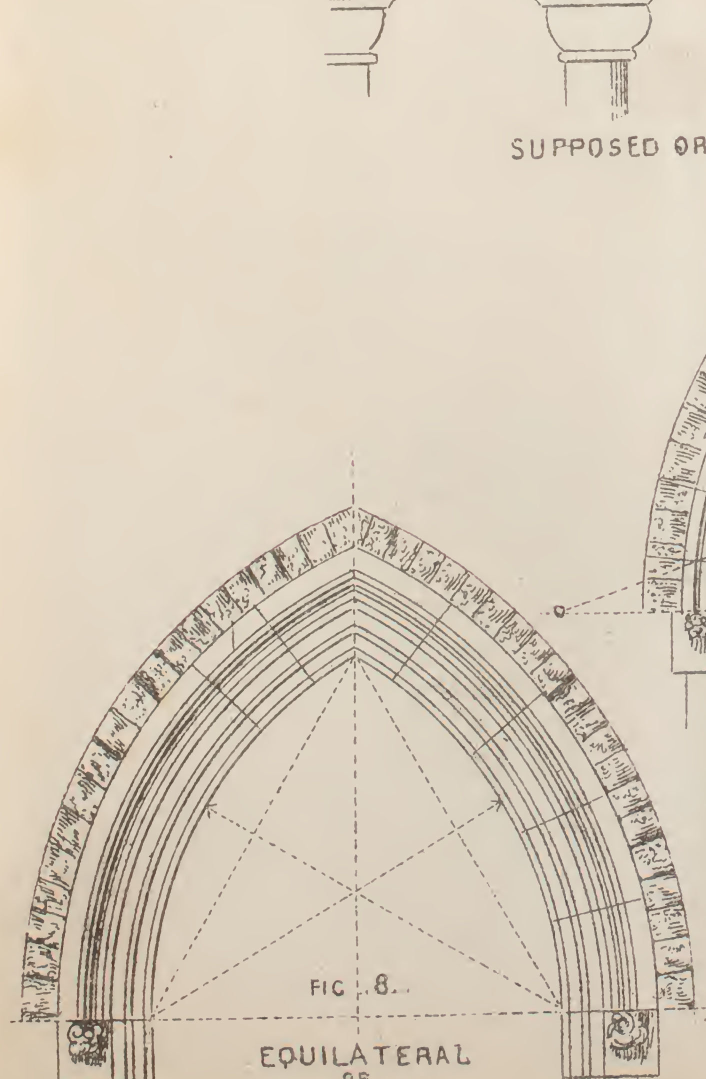


FIG. 8.

EQUILATERAL
OR
DECORATED.

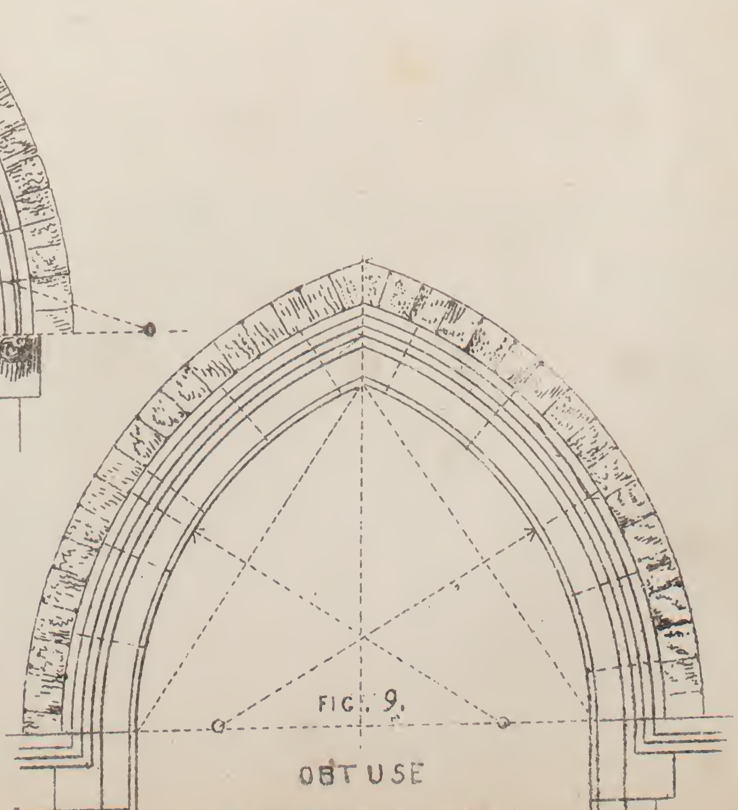
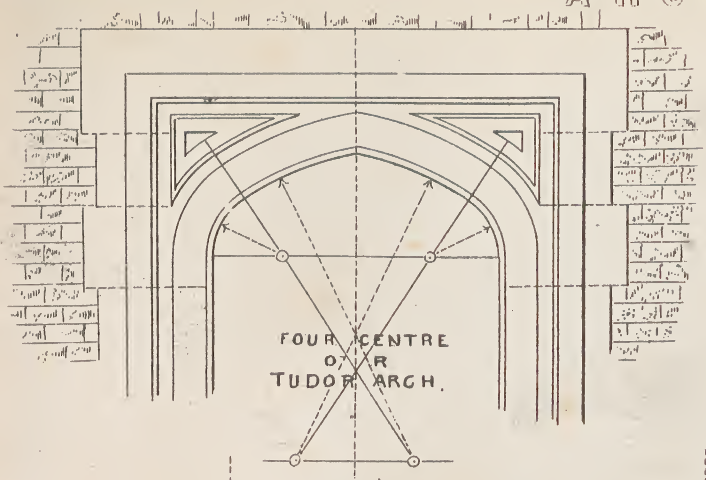


FIG. 9.

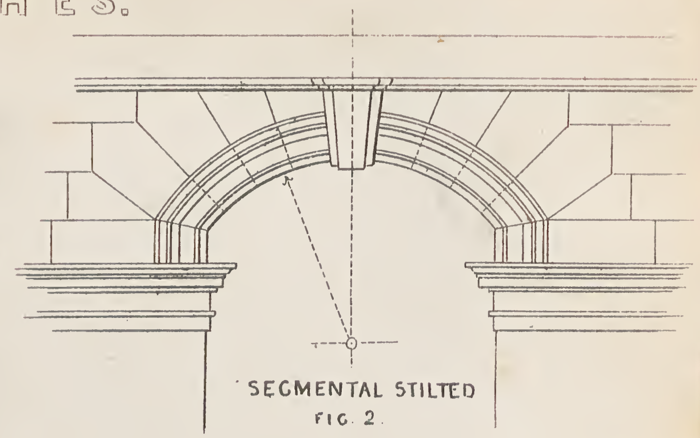
OBTUSE
PERPENDICULAR.

ARCHES.



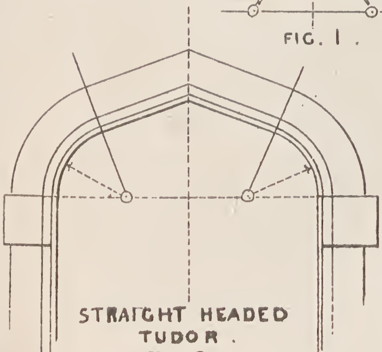
FOUR CENTRE OR TUDOR ARCH.

FIG. 1.



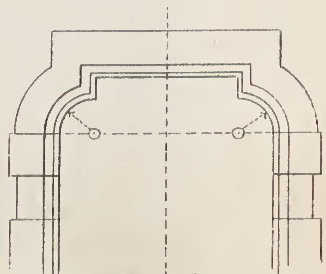
SEGMENTAL STILTED

FIG. 2.



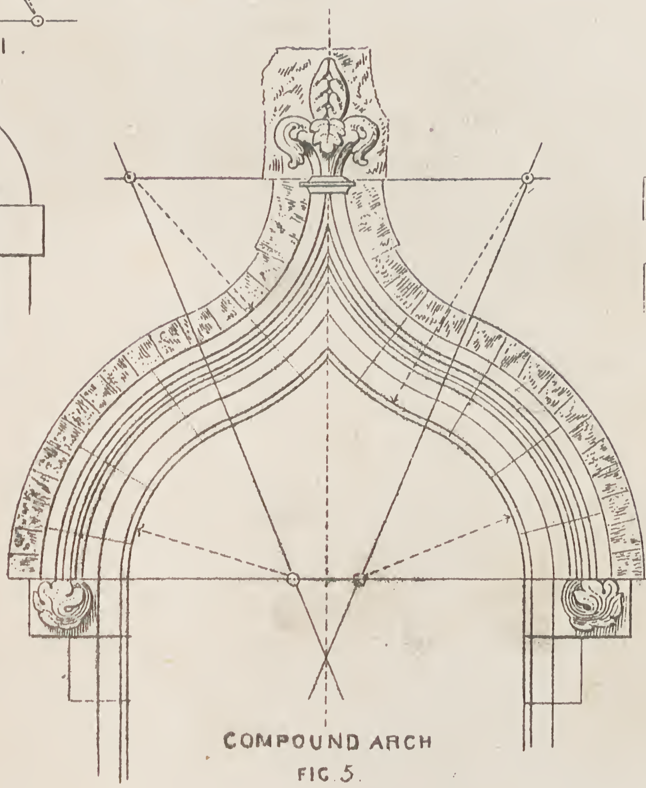
STRAIGHT HEADED TUDOR.

FIG. 3.



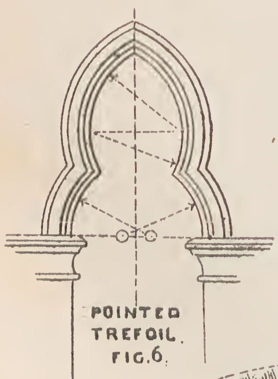
SQUARE HEADED TREFOIL.

FIG. 4.



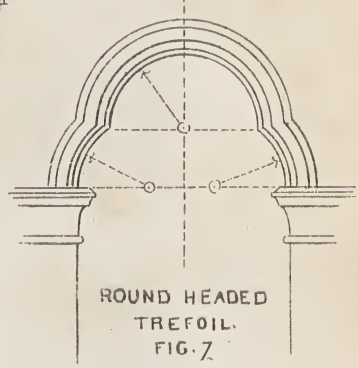
COMPOUND ARCH

FIG. 5.



POINTED TREFOIL.

FIG. 6.



ROUND HEADED TREFOIL.

FIG. 7.

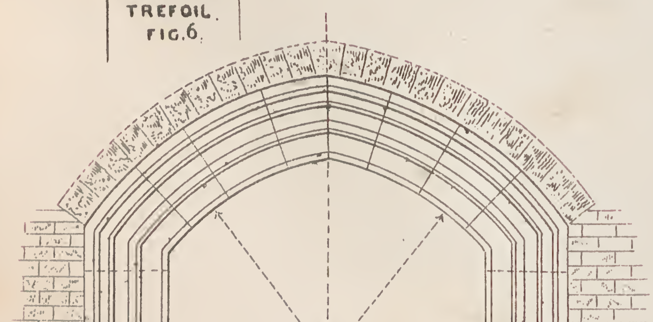


FIG. 8.

FLAT POINTED.

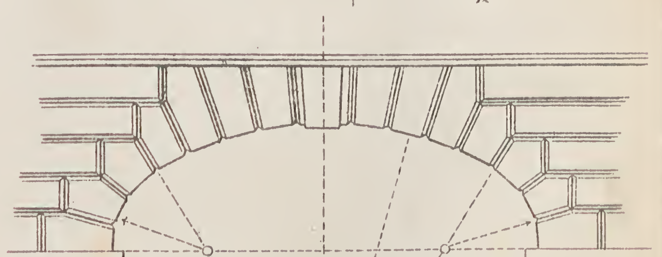


FIG. 9.

SEMI ELLIPTICAL.

Brooks Archt.

we have prepared three plates, by a careful examination of which we trust they will be enabled at one view to understand the several varieties. On plate 4, *Figs.* 1 and 3 are Arabian arches; and *Fig.* 2 is what is termed the "Horse-shoe," or Saracenic arch. The faces of Arabian arches are frequently profusely covered with elaborate ornamentation of fanciful combinations, the forms of which have frequently been derived from a careful study of plants and flowers, the religious scruples of Mahommedans not admitting the imitation of human or animal forms. A beautiful example of the horse-shoe arch, fully enriched, is to be seen as a doorway at Tarragona, in Spain; but should the student wish to obtain a correct knowledge of the Moorish style without the expense and inconvenience of foreign travel, we advise him to study the general arrangements and details of that extraordinary work the Alhambra Court, by Mr. Owen Jones, at the Sydenham Crystal Palace, which comprises a reproduction of a portion of the noted palace of the old Moorish kings at Granada. *Figs.* 4 and 5 are semi-circular-headed arches: the first is the ordinary form, as practised by the modern Italians; and the second is an arch used in Norman architecture, as applied to churches, cathedrals, and other edifices. The enrichments of this arch, it will be observed, are novel in their details, being formed of cabling, zig-zag work, and billets. Some of the finest remains of highly enriched arches of this description are to be seen in the cathedral and castle of Durham, one in the cloisters of the first of which, leading to the southern aisle, is probably the most curiously elaborate in the kingdom. *Fig.* 6 displays a portion of a Gothic arcade, showing the supposed origin of the pointed arch, which has been previously described at page 25. This example, however, indicates the characteristics of the mouldings and the ball ornaments with which they are sometimes embellished. Examples of these arcades may be seen in the Norman portions of the cathedrals of Canterbury, Ely, York, Lichfield, Lincoln, and Durham. *Figs.* 7, 8, and 9, are also Gothic arches. *Fig.* 7 has inserted in one of its sides the nail-head or dog-tooth ornament, so illustrative of the "Early English" period of Gothic architecture.

On *Plate* 5, *Figs.* 1 and 3, are shewn what are designated Tudor arches, viz., those that were used in England during the reigns of Henry VII. and VIII. *Fig.* 2 is termed the segmental stilted arch, occasionally employed in Italian architecture. *Figs.* 4, 5, 6, 7 and 8, are all arches that may be classed under the category of Gothic, and will be readily comprehended by a careful inspection of the engraving. *Fig.* 9 is the semi-elliptical arch, much used by Palladio, Inigo Jones, Wren, and their followers.

We may inform our readers, that the ancient Romans and the Mediæval Masons had two distinct methods of constructing their arches. The former people generally used rude, simple, wedge-shaped stones or voussoirs, although examples occur where two courses of voussoirs have been employed, as at Autun, in Burgundy, over an opening in a tower of Roman work, and, in some instances, their arches were constructed with bricks and stones alternately, as may be seen in works at Le Mans and Bourges. The Gothic architects adopted a different principle, by constructing their arches of several courses or rings of voussoirs, each of which projects in front of the one below it,—a more complicated mode of procedure, but which produces a great amount of light and shadow. In the early examples of Mediæval

ARCHES

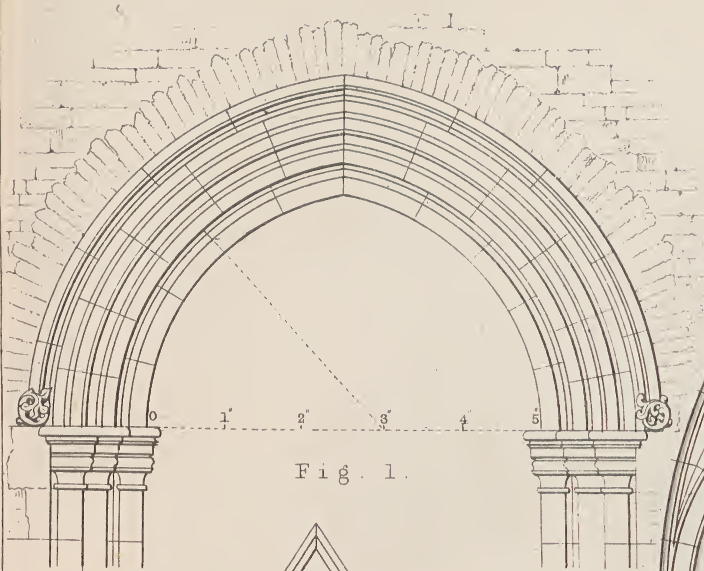


Fig. 1.

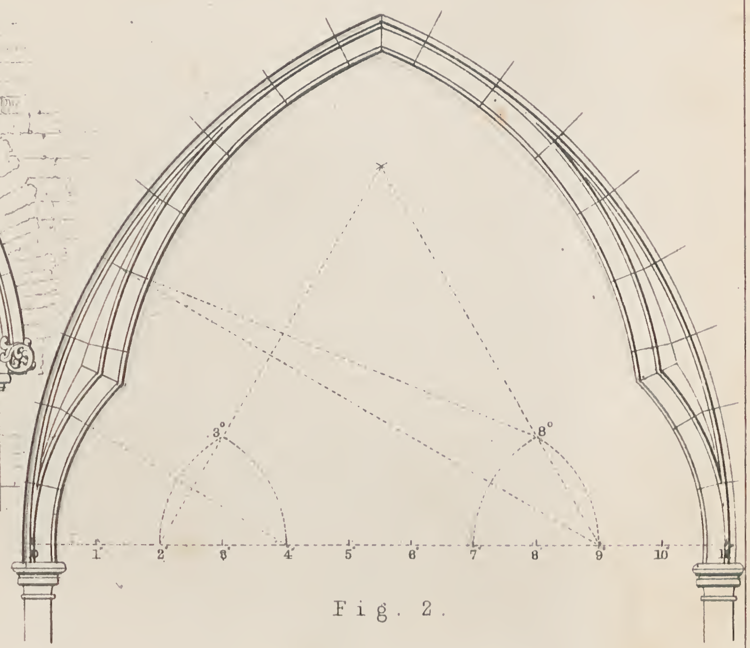


Fig. 2.

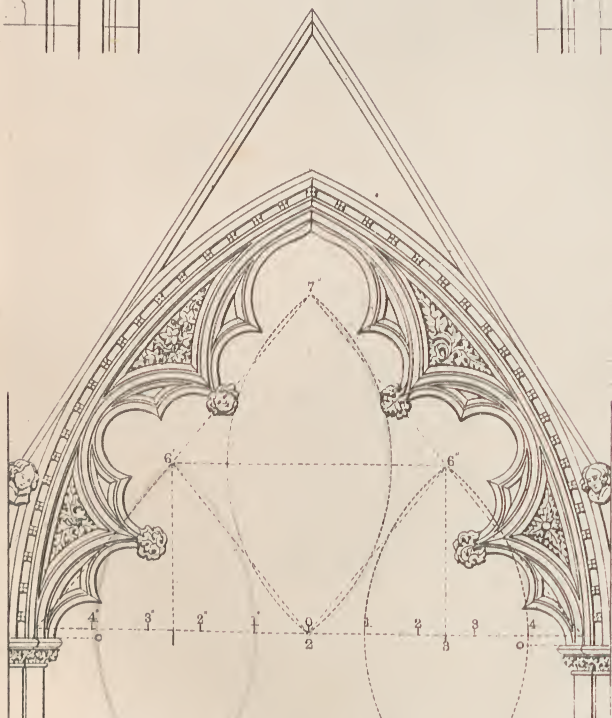


Fig. 3.

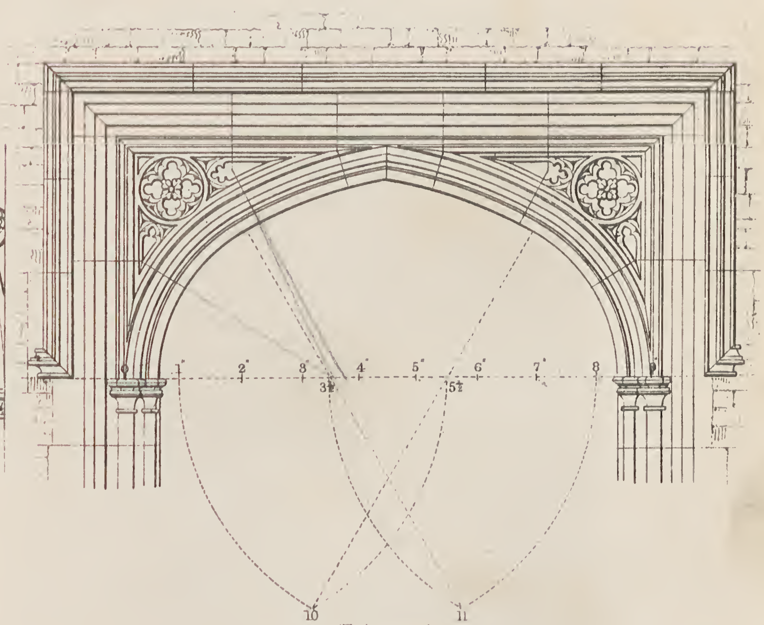
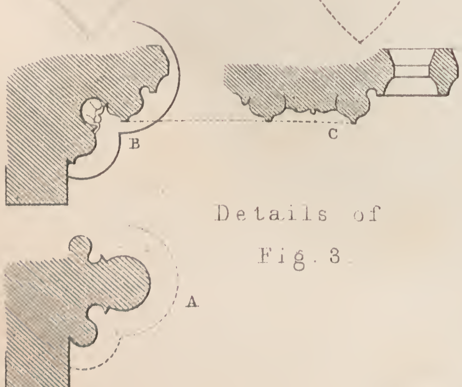


Fig. 4.



Details of Fig. 3

Fig. 5.

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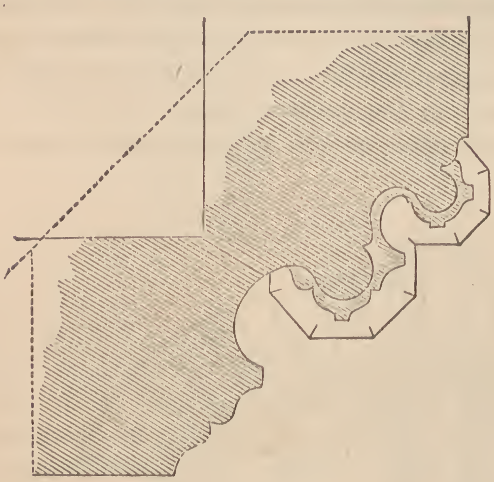
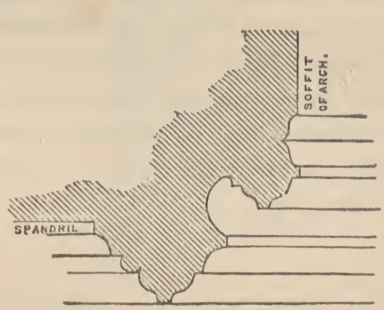
Fig. 3 represents a foliated arch with double featherings, viz., featherings or cusps on two different planes. The same general principles are observed in describing these arches, as may be seen by consulting the plate; but the featherings in ancient examples are greatly varied in forms and treatment. This design is of the Early Decorated period, in which the principal spandrils are carved, and sometimes both the principal and the minor ones; but in later examples they are ornamented with pierced tracery. The radiating joints must be carefully maintained, care being taken to work the carving in single stones as far as possible. The details of this arch are drawn beneath it to a scale large enough to enable the student to judge of the contour of the mouldings used at this period of Gothic architectural development.

Fig. 4 is a four-centred arch of the perpendicular period. This arch is formed by the space from 0 to 9 (the leading fillet being taken as the guide). This must be divided into nine parts; upon the bases 1, $5\frac{1}{2}$; 8, $3\frac{1}{2}$, describe the inverted equilateral triangles 1, 10, $5\frac{1}{2}$; 8, 11, $3\frac{1}{2}$; and from the points 10, $5\frac{1}{2}$, and 11, $3\frac{1}{2}$, the arch is struck. The details are drawn in





the accompanying illustration to a large scale, with the shafts and the arch mouldings clearly indicated, and a section through the spandril. The jointing is arranged so that the centre figure of the spandril is one stone, and the planes of the joints meet in the centre of the small points of the spandrils. This is advisable for economy of material, or where the spandril cannot be obtained in one stone thick enough to work it out of, and give the stones above a bed sufficient to secure them without any pressure on the spandril.

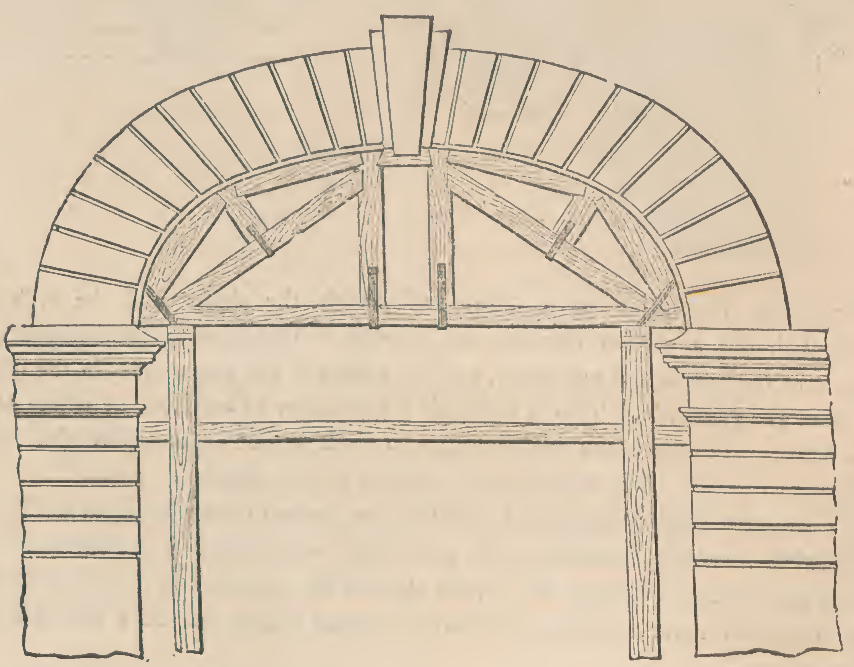
Fig. 5 is an early English segmental arch from an ancient example over a tomb; it may be used, either with or without capitals, with good effect where there is a deficiency of height. This form of arch is to be found in the Gothic style of all periods, and it is sometimes foliated.

Having described several modes of drawing Gothic arches, we add a few observations on their construction:—

The mason, in order to put a design into execution, must set out the arch full size in

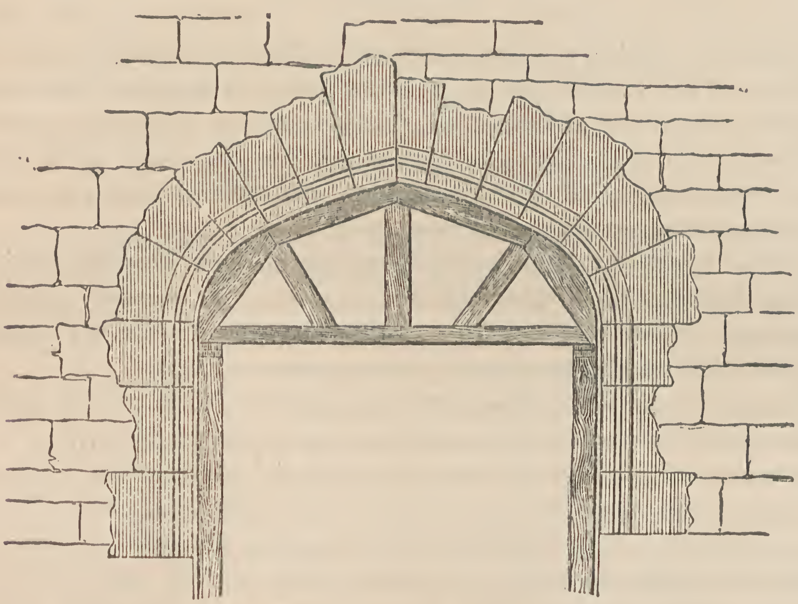
elevation on a drawing board, with the joints marked thereon. The next process is to make the moulds, for which thin sheets of zinc are best adapted : the bed-moulds are to be formed by laying the drawing on a sheet of zinc, pricking through the lines with a fine point, and then cutting the zinc to the form of the required sections. The face-moulds are to be obtained by laying the zinc upon the full-sized drawing of the arch, describing the lines, and then cutting it to the requisite shape. Where arches are formed of one curve, and the voussoirs are all of one size and shape, one mould will be sufficient, except for the key-stone. The moulds being thus obtained, and numbered or lettered for their respective situations, the stone is to be worked to a level face, and the face-mould applied and marked, the joints worked, and the section or bed-mould applied and marked. The mouldings are next to be worked to the required curves, the mason being guided by those rules cut to the required shapes, or guaging the lines, where practicable, from the soffit of the mould.

In setting the stones, the delicate mouldings and projections should have the joints left open at the outer-edge, so that the pressure may be confined to the solid parts of the stone until all is set and sound; the mouldings may then be stopped some time previous to being cleaned down. Plugs of slate or hard stone (not iron) should be inserted where required, and set with Portland cement and sand, in order to connect the voussoir stones more firmly together. The mouldings should be carefully worked to the sections given; and, if the workman understands the peculiarities of the various styles, he will be greatly aided in preserving the spirit of the designs.



Centering for Arches.—The annexed diagrams show the nature of what are termed

centres, or the supports of stone or brick arches, domes, or groined vaults, during the progress of their construction. The centre is made of rough timber by the carpenter, who should be enabled, by the aid of a careful study of the works of Tredgold, Nicholson, Tarbuck, and others, who have written scientifically on the art of carpentry, to calculate the strength of the



timbers to support the superincumbent weights which they have to sustain. We deem it superfluous to enter fully into this matter, in a work which relates only incidentally to carpentry. It may, however, be observed, that the requisites of a centre are strength, and the means of keeping the stones of the arch in exact position during its erection, the precise curve of the intrados having been previously determined before working the voussoirs to their proper shapes. The use of wedges under the centre greatly facilitates the removal of them, and gives an opportunity by gently slacking them to allow the subsidence, if any, to distribute itself over the whole arch.

The elliptical arch, shown on the preceding page, is to a scale of a quarter inch to the foot; and the Tudor one is six feet three inches in width.

The joints of the voussoirs in the elliptical arch are drawn from their *true centres* by means of the trammel. The trammel we have previously described at page 28, and have now only to request our readers again to refer to it as the most useful instrument yet invented for drawing the ellipsis and finding the joints of the stones for elliptical arches. The joints for the Tudor arch, adapted for an opening, are found according to the diagram, page 29, on "Tudor Arches."

CHAPTER VI.

THE DOME.

We now proceed to explain and illustrate what is called the *Dome* (from the Latin word *Domus*). That over the Pantheon, at Rome, is the earliest in existence; and the custom of erecting cupolas or domes over cathedrals, &c., became prevalent during the period in which Italian architecture had sway over a large portion of Europe. From about the year 1400 to 1700, the Italian name for a cathedral, *Duomo*, was transferred from the church to the peculiar kind of roof characterised by the dome.

The Dome or Cupola (the latter term being also derived from the Italian) consists of a roof, either hemispherical, or of any other curve, constructed to cover a circular, elliptical, or polygonal area. Some writers on the subject have classed (but, we think, somewhat erroneously) the spire, steeple, and pyramid, in the category of domes.

To design and construct a *stone dome* on a large scale, so that it shall resist the effects of time and climate, and last for several centuries without repair, may be considered one of the greatest triumphs of architectural and masonic art, which circumstance may account for the very few examples in the world that are really satisfactory, either in design, execution, or durability. At first sight, it would appear that the dome is a much more difficult piece of work than a plain arch; this is, however, not actually the case in absolute practice; for when we examine potters' kilns, bakers' ovens, and glass-house cones—some of the latter of which are of vast extent, erected by ordinary bricklayers, with materials, in many cases, of an inferior nature, as compared with good stone—our wonder ceases, and we naturally come to the conclusion that the fact of curvature in the horizontal direction, or the continuous abutment of a circular basement, gives considerable extra stability to the superstructure.

It should, however, be remembered by the designers and builders of domes, that they have both vertical and lateral thrust to contend with and overcome. The former should be counteracted by the excellence of foundations, and the latter by the strength of the basement-walls, or piers, on which the tambour of the dome rests. Domes are seldom built upon walls continued all around uninterruptedly below the springing-line. The dome itself, as a general rule, rests on massive piers, which, in some cases, are further strengthened by buttresses of solid masonry, provided as a counterpoise to the lateral thrust of the hemispheric superstructure.

The Dome of the Pantheon, at Rome, may be taken amongst the earliest structures of the kind laying claim to those constructive qualities that stamped the first great atchievement of arched principles where a large circular area was to be covered by a hollow shell of masonry. In more modern times those of St. Peter's, at Rome, and the Pantheon, at Paris, are the most celebrated; for, although our own St. Paul's, in London, is far superior to the above two

buildings in external picturesque beauty, we cannot possibly admit its dome amongst those actually built of stone or brick, it being merely an outer frame-work of timber covered with lead, with its small lantern at its summit, supported by a brick cone. In fact, according to a great authority on the subject—Professor Donaldson—there is not, strictly speaking, a real stone dome, deserving the name, in Europe, except that of the Pantheon, at Paris. St. Peter's, at Rome, great and extraordinary as it appears, was constructed on the ribbed principle, and filled in between with a species of concrete—a similar course having been adopted inthe Roman Pantheon. The Dome of the Cathedral of St. Isaac, at St. Petersburgh, is of iron; so is that of the reading-room of the British Museum, London.

THE THEORY OF DOMES.

As we have previously observed, the stone dome is "a roof either hemispherical or of any other curve, constructed to cover a circular, elliptical, or polygonal area," and in all cases its walls of support should be of great strength. When the plan is circular, the basement and drum on which the dome rests should be built of massive masonry in horizontal courses, the coursing joints of the superstructure forming the semi-sphere, which is hollow, being also horizontal; their various joints are the surfaces of right cones, having one common vortex in the centre of the hemispheric surface, and also one common axis, so that the conic surfaces will terminate upon the spheric surface in horizontal circles. In further elucidation of the subject, we may state that the joints between any two stones of any course are in vertical planes, passing through the centre of the spheric surface, and consequently they will intersect each other in one common vertical *straight* line, passing through the spheric surface from the base of the dome to its apex.

The line in which all the planes that pass through the vertical joints intersect, is called the *axis* of the dome. The circumference of the horizontal circle, which passes through the centre of the spheric surface, is called the *equatorial circumference*, and any portion of this curve is called an equatorial arc. The circumferences of all the courses of stones above the base or springing-line of the dome, which are parallel to the equatorial circle, are called *parallels of altitude*. The intersection of the axis of the spheric surface is called the *pole of the dome*. The arcs between the pole and the base of the dome of the circles, formed on the curved surface by planes which pass along the axis, are called the *meridians*, and any portion of these meridians are called meridianal arcs. The conical surfaces of the coursing joints terminate upon the semi-spheric surface of the dome in parallels of altitude, and the surfaces of the vertical points terminate in the meridianal arcs.

Hence, in domes where the extrados and intrados are obtained by concentric hemispherical surfaces, two apparent sides of each stone, contained between two meridianal arcs, and the arcs of two parallel circles, are spheric rectangles, the two sides, forming their vertical joints, being of two equal and similar frustrums of circular sectors, and the other two sides, forming the beds of the stones, are frustrums of sectors of *conic* surfaces.

In the construction of domes, as the stones are placed upon conical beds that terminate upon the curved surfaces in the circumferences of horizontal circles compressed between level planes, they may be said to be essentially horizontal.

It has been universally admitted, by those who have paid much careful attention to the forms of domes both internally and externally, that the strictly semi-circular sectional shape is wanting in grace and that imposing effect of altitude and dignity so eminently conducive to grandeur of result, and more particularly for its strength. The upper part of a semi-circular dome presenting a surface for some extent comparatively flat, does not offer the advantages for equalising the pressure around its centre, and some distance down towards its springing as a dome worked from two centres. In illustration of this, we refer our readers to *Plate 5b*, in which it will be observed that satisfactory effects may be produced by using the most simple means with the greatest facility, by adopting the parabolic or catenarian forms, such as were employed at St. Peter's, at Rome, the Pantheon, Paris, and St. Paul's Cathedral, London.

In producing the peculiar form of dome, as shown on *Plate 5b*, *Fig* 1, divide the internal base line A B into 7 equal parts, then erect the perpendicular line D C E at right angles to it, and from the centre D describe the semi-circle A C B, as shown by the dotted line, which, in contrast with the line of the outer dome, as displayed at 1, 2, 3, 4, &c., proves the inferiority of the purely semi-circular form.

To find the centre for describing the outer curve of the dome, at the division 6 of the base line A B, make the line 6 G at right angle to it, and equal to one-fourth of one of the divisions A 1—1, 2, &c., when the point G gives the centre from whence the outer curve is drawn, and also is the centre from which all the joints must radiate that form the outer crust of the dome. F is the cornice at the springing of the dome, and below it is a portion of what is technically called the drum or tambour of the structure. It is most desirable to give to the base of the dome a portion of the vertical above the cornice, to compensate for a part of the fore-shortening in perspective, caused by the projection of the cornice, and prevent that appearance of the curve having been described much below the uppermost line of the cornice.

Fig. 2 is the half plan of the dome, taken through the lantern, with its cornice and tambour, showing all the horizontal and vertical points of the work. The first leading divisional line being formed by the arcs *c d e f;* from any convenient points in the circle, as *a* and *b*, as centres, describe the arcs *c* and *d*, which gives the position of the first divisional line ; the positions of the other joints being found in the same way. It is scarcely necessary to observe, as will be seen, that the whole of the vertical joints must tend accurately to the centre O.

Fig. 3 exhibits the elevation of a dome in perspective, on which the two usual modes of construction are illustrated. The left side is formed in horizontal courses, and the right by means of stone ribs, filled in between with rubble-work or concrete, the latter mode, combined with pozzalani, having been adopted in the building of the Pantheon, at Rome. X X X X X X is the equatorial line of the dome, for this reason, viz., that it divides the sphere into two equal parts. The lines *d d*, *e e*, *f f*, and *g g*, &c., are the parallels of altitude.

CATENARIAN DOME.

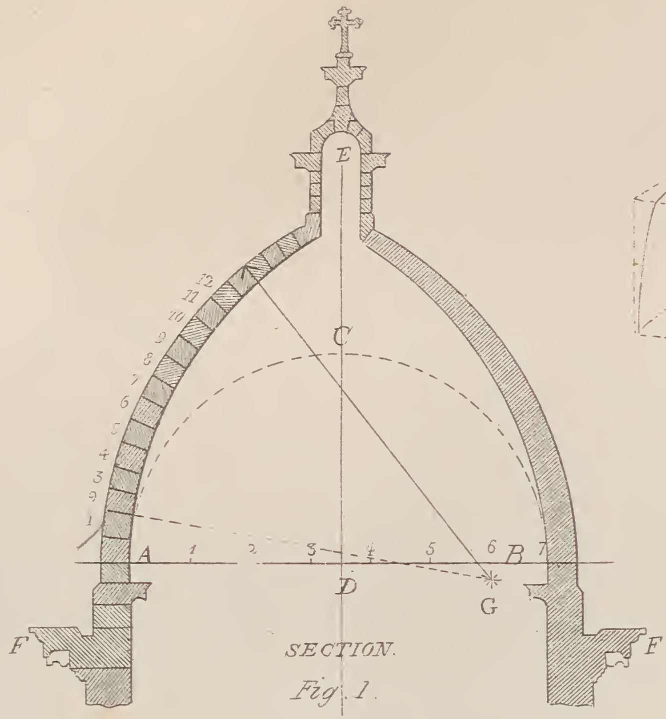


Fig. 1.

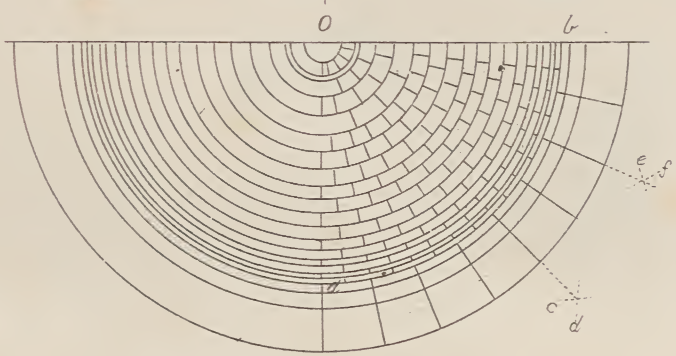
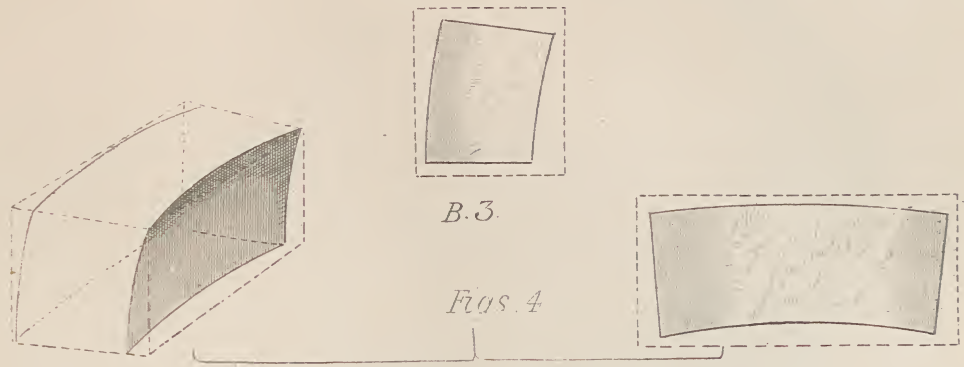


Fig. 2



B. 1.

B. 3.

Figs. 4

B. 2.

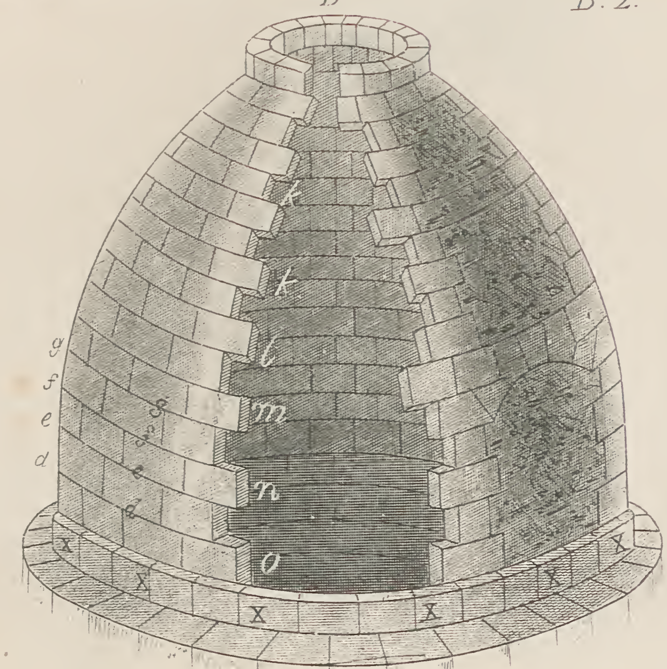


Fig. 3.

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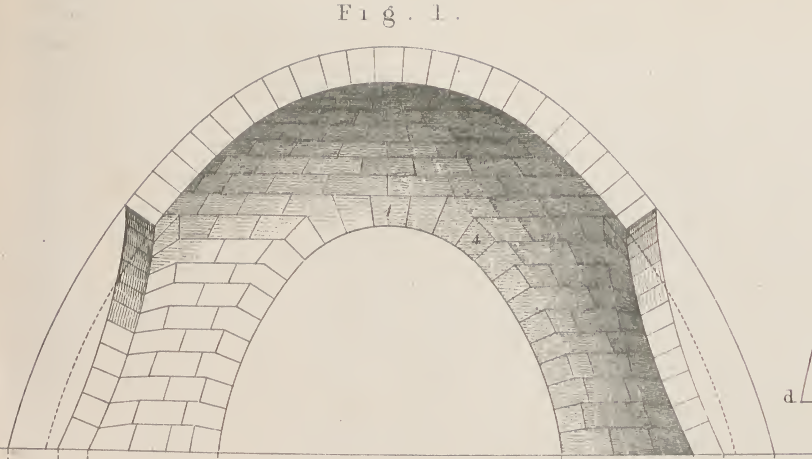
CONOIDAL DOME

Fig. 1.



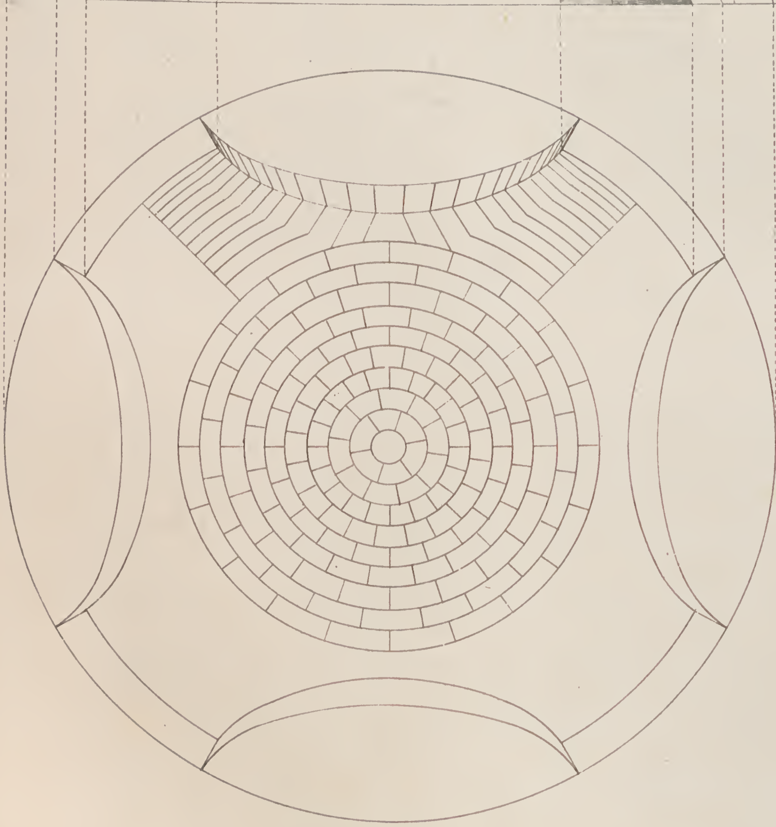


Fig. 2.

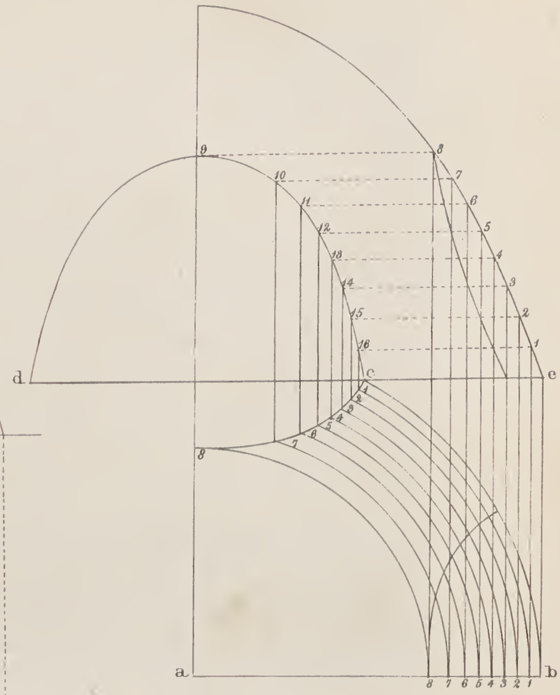


Fig. 3.

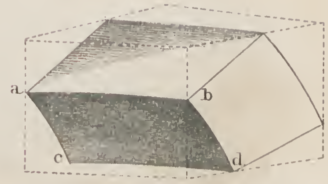


Fig. 4.

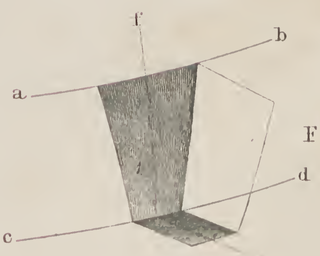


Fig. 5.

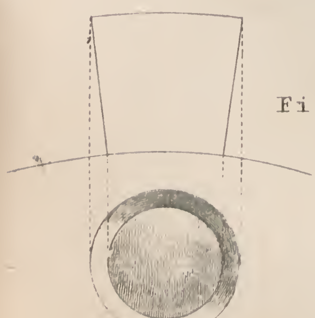


Fig. 8.

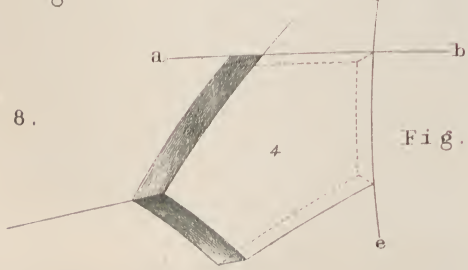


Fig. 6.

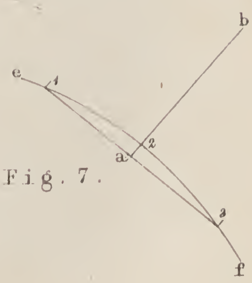


Fig. 7.

ascoyne, Archt.

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Fig. 4, illustrating the form of the stones required in the construction of a dome of this description, represents their shapes at the points in the elevation A, B, C respectively. B 1 shows the shape of the stone in perspective, after having been hewn from the rough block. B 2, is the plan of the stone at its lower bed, and B 3 is its end elevation. It has been already observed, that the whole of such stones are spherical rectangles, the extrados, or upper surfaces, of which are of course convex, and their intrados, or under surface, concave, as is shown in the diagram B. In the sectional cut through the dome, at *o*, *n*, *m*, *l*, *k*, and *h*, the ends of the stones are seen in perspective, and at D is shown a void or opening at the top, with the base for a lantern.

Constructively considered, it must be borne in mind that the stability of a dome depends upon the proper application and action of a very different principle from that which operates in the case of the ordinary arch, and, as a general rule, being correctly built with reference to such different and peculiar principle, its relative security and power is greater and more extended. The dome also differs in another important point, namely, it may be left unperfected, or open at the apex or top, as represented in the plate just referred to. This is consequential upon the several points of the masonry being formed to tend equally in every part to the vertical vortex of the hemisphere as a common centre. In an arch of equilibration, therefore, such as the dome essentially is, the open apex or unclosed top, may exist without prejudice to its self-supportive, or the further power of sustaining any minor or superincumbent structure, such as the usual feature of a lantern before mentioned, the weight of which shall not exceed that of the crowning circular segment of the dome which is omitted. A load greater than this would so act as to dislodge the upper portion of the dome, by causing an upward spring or tendency in some of the courses next its hypethral opening.

In reference to the most graceful form for domes, the ellipsoid or parabolic, as has been before stated, is to be preferred. This is the form adopted in that of St. Peter's, at Rome, in which the longer axis is perpendicular to the horizon. The parabolic, or catenarian curve, is that also used in the interior of the Pantheon, once the Church of St. Genevieve, at Paris, in reference to its dome—the lunettes being conoidal.

In *Plate* 5 *c*, *Figs.* 1 and 2 represent a catenarian dome, with lunettes such as that of the Pantheon, at Paris, just mentioned. The joints of the masonry are perpendicular to a tangent at any point of the curve. To project the lunette on the plan, as at *Fig.* 3, divide the curve of the dome, to the extent of the given height of the lunette, into any number of parts, equal or unequal; let fall perpendiculars from these points, say eight in number, to the line *a b*, then on *a*, as a centre, describe the series of arcs *b c*; 1 1; 2 2; 3 3; &c., draw parallel lines from numbers 1, 2, 3, 4, 5, &c., to 16, 15, 14, 13, &c., horizontally to the edge of the lunette; let fall perpendicular lines, also, from these points, cutting the arcs below at 1, 2, 3, 4, 5, 6, 7, and 8. Next, draw a curve through these points from the corresponding numbers on *a b*, and one half of the lunette curve *c* 8, will be projected on the plan. *Fig.* 4 shows a voussoir, each edge of which is a horizontal section taken through the dome at the top and bottom edge of

each division of the courses; *a, b, c, d* show the horizontal lines. At *Fig.* 5, the horizontal lines are correspondingly marked *a b*, and *c d*, and the vertical curve *e f* represents part of the vertical section of the dome, as taken at the particular point marked 1 on the keystone of the lunette. *Fig.* 6 represents another stone marked 4, on the arch of the lunette; *a b*, is here again the horizontal section at the point taken, and *e f*, the vertical section. *Fig.* 7 exhibits the most simple mode of drawing a line perpendicular to any tangent, at any particular or given point of a dome; as for example, set off 1, 2, and 3, on the curve *e f*, representing a portion of the vertical section; connect 1 and 3, and perpendicularly to the chord 1 3, through the point 2, set up the line *a b*, which will be the perpendicular required at the point 2. *Fig.* 8 shows a plan and section of the keystone, the manner of setting out which is therein rendered sufficiently evident.

In the dome of the Baptistry at Pisa, which is another remarkable structure of the kind, there is a departure from, or rather non-consideration of, the preferable forms before mentioned; useful for the purposes of comparison, and interesting as showing the real constructive form undisguised, and so used. The form of this dome is that of a polygonal cone, surmounted by a smaller cupola of parabolic section. The lower structure, on which this dome is based, is circular on plan, and 95 feet diameter within the walls, which are 12 feet in thickness. The inner arrangement is a peristyle of columns 3 feet in diameter, and 31 feet in height, from which rise arches supporting a horizontal cornice, 46 feet from the floor line. On this a series of square piers and arches, with a second horizontal cornice, give an additional height of 38 feet, making a total altitude of 84 feet to the springing line of the inner polygonal cornice of the conic dome, the lateral thrust of which is received and counteracted by arches turned from the piers of the outer wall, acting as abutments, and connecting the inner and outer dome. The wall of the outer dome is 2 feet in thickness, and is truncated where it intersects, at its upper part, the inner cone. The wall of the latter is 2 feet thick at the base, and 1 foot 6 inches at the upper part, and it rises in nearly an upright line to a vertical height of 67 feet, where it is no less than 26 feet in diameter, and is there surmounted, as before observed, by a smaller parabolic cupola, terminated externally by a statue, at a grand total height from the ground of 174 feet.

The design of this dome was the work of Diote, or Diodote Salvi (*circa*, 1150), and in it we doubtless see the prototype of the subservient or immediate cone employed by Sir Christopher Wren, in St. Paul's Cathedral, where, simply a feature of construction, the æsthetically less pleasing form of the cone is hidden by the inner hemispherical dome, as may be seen on referring to *Plate* vii., *Fig.* 1, where a section through this portion of this edifice is given, for the purpose, more particularly, of showing the iron chains and crampings, &c., used in its construction.*

* In the church of the Invalides, at Paris, the same idea of a secondary inner dome is carried out—not, however, for a like reason, or with a similar intention of concealment, as in this instance the principal inner dome is hemispherical, and is to a large extent seen through the very extended opening left in the upper part of a lower one, also hemispherical, springing immediately from the cornice at the foot of the tambour.

With respect to this undisguised use of the conical dome of Pisa, Mr. Donaldson observes, that, "content with overcoming the scientific difficulty of the construction, which," he adds, "evidences great practical ability and sound experience"—little pains or thought seems to have been taken "about concealing the certainly ungraceful form of the cone," to which latter point, later architects, in their treatment of the dome, would appear to have been more fully alive, and more studious of qualifying.

Another celebrated dome, and on a larger scale than that of Pisa, just noticed, is that of Santa Maria del Fioré, at Florence, commonly called the Duomo of Florence.* This dome, however, differing from that of Pisa, and the more modern one of the Pantheon at Paris†—the former of which approaches more nearly to, and the latter properly, a stone dome according to the strict application of the word—is constructed on the ribbed principle, exhibited in that of St. Peter's, at Rome, and other instances. It varies also in plan from both the former-mentioned examples; the Dome of Brunelleschi‡ being octagonal in this respect, that of Pisa, polygonal, and that of the French Pantheon, circular. It is composed of sixteen ribs, united by a double arc, or rather two casings or thicknesses of filling-in vaulting. Its tambour is 42 feet 2 inches in height, perforated by eight large semicircular-headed windows, 15 feet in width. At the uppermost line of the tambour—the thickness of the wall at this level being 14 feet—the cupola commences to spring, having its solidity, from above the height of 12 feet, divided as before mentioned, the inner or under arc being turned in 8 feet of substance, and the outer one in about 4 feet.§ The diameter of the dome at its springing is 138 feet 6 inches, and the height to the lantern 106 feet.

In relation to the constructive qualities and principles of this particular dome, it has been asserted that, according to Brunelleschi's own description of his work, he was clearly of opinion that

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* It was to a church of the cathedral rank that the tholus, cupola, or dome, was first applied in modern practice; hence the Italian custom of calling an episcopal church *Il Duomo*, and the application of the term in its restricted sense.

† The Pantheon, at Paris (formerly the church of St. Geneviève), was designed by Jacques Germain Soufflot, who greatly distinguished himself by his architectural works during the reign of Louis XV. This work of Soufflot, however, was not perfect, for after his death, Brebion, who succeeded him, was commissioned to correct several failures that had appeared, believed by some to have originated in the bad workmanship and method which had been adopted in constructing the piers, while others contended that they were caused by the foundations not being good:

‡ The edifice of Santa Maria del Fioré was commenced in 1298, from the designs of Arnolfo de Lapo, but he dying before the level of the dome was attained, the latter was erected by Brunelleschi.

It is recorded that the original design of Arnolfo was lost, and that the work rested until the return of Brunelleschi from his studies at Rome, when the task of completion was referred and ultimately entrusted to him.

§ This difference in the substance of the inner and outer arcs is observable also in St. Peter's, at Rome, and it has been assigned as a reason for such greater thickness of the former, that "it has to bear, to some extent, the strain of the ties."

the strength and stability rested in the ribs, and not, it may be observed, as in the case of a stone vaulted dome properly so distinguished, on the double vaulting here employed as the connecting or intermediate filling-in ; an opinion fortified by his direction that the inner vault—the outer one being described as necessary to protect the former from the weather—" after it had been raised to a certain height should be formed of the *lightest materials that could be found*, while the ribs were to be built up *throughout* of solid stone." Further, as regards the double vault in this case, it has been suggested, and is highly probable, that, while the filling-in acted to stiffen the ribs and complete the vault within and without, the hollow space obtained between the inner and outer arcs was desired and designed with a view to lessen weight as far as possible, a result the separated arrangement of them in a very ready and simple manner secured.

Another peculiarity of this dome, as distinguished from that of Pisa and other instances, is, according to Mr. T. Hayter Lewis—a good authority on the subject, already referred to—that " the whole mass rises clear above all the surrounding parts of the edifice, showing that it is quite self-supporting, and that it derives no strength from external abutments of any sort"—a point of great importance, both scientifically and architecturally considered.

In this review of the application of the domic theory and principle, it is deemed unnecessary to include the many examples partaking of the character of the dome, which might be enumerated, as beyond those already specially mentioned, they are—if we exclude, perhaps, the domes of India, and those of one or two other Eastern nations, the notice of which would extend without adding to the practical use of the observations made—rather imitative productions of the form simply, for the most part, in a material to which the rules of masonic construction only indirectly and in very limited measure refer, or are altogether inapplicable. In the case of St. Paul's, London, the external and superior dome is a construction of timber covered with lead, the inferior internal one and its connected cone, being of brick, and the only one which may be considered as treated constructively after the manner of masonry. The dome of the Invalides, at Paris, is also of timber-frame. That of Sancta Maria della Saluti, at Venice, is likewise of timber, while the Dome of St. Isaac, at St. Petersburgh, is mainly constructed, like that of the reading-room of the British Museum, of iron.* The immediate purpose here sought is, that of practical utility to the mason, and reference confined chiefly to the points and principles with which he would be more particularly concerned, and, as a consequence, interested. Description, therefore, of these timber built features in either case would be superfluous, and it it will be more to the purpose to observe, that the timber-framing of Santa Maria, at Venice, covers an inner dome of brick 70 feet in diameter ; that of the Invalides, a double dome of stone, in relation to which, of course, masonic principles of construction are, in the one case relatively,—as they are also in St. Paul's, before mentioned,—and in the other directly employed.

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* A very useful description, with a section shewing the construction of this dome, from the pen of Professor Donaldson, is given in the *Builder* of December 16th, 1848, Vol. VI.

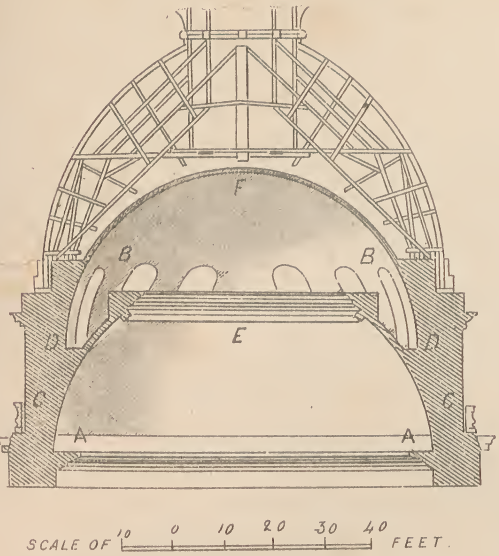


Fig. 7.

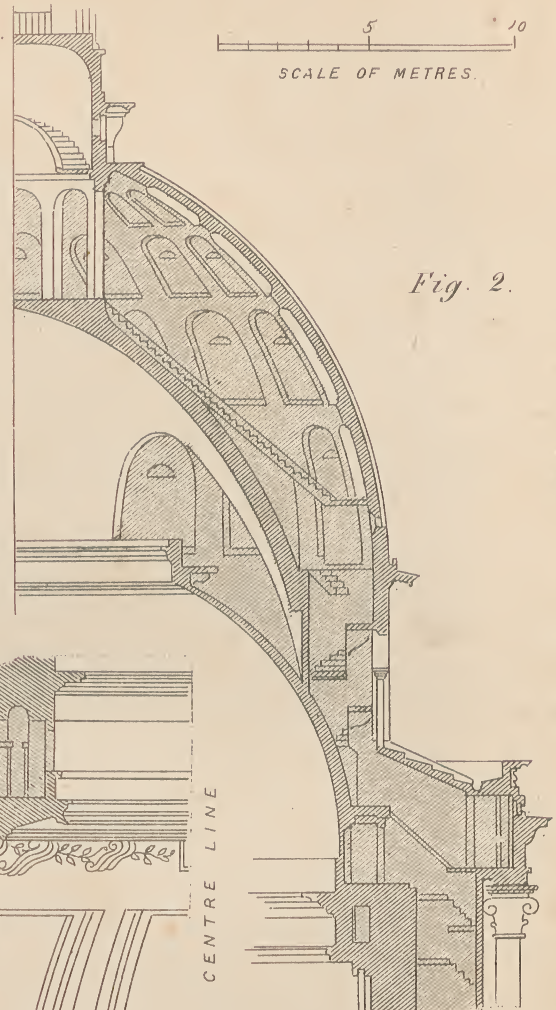
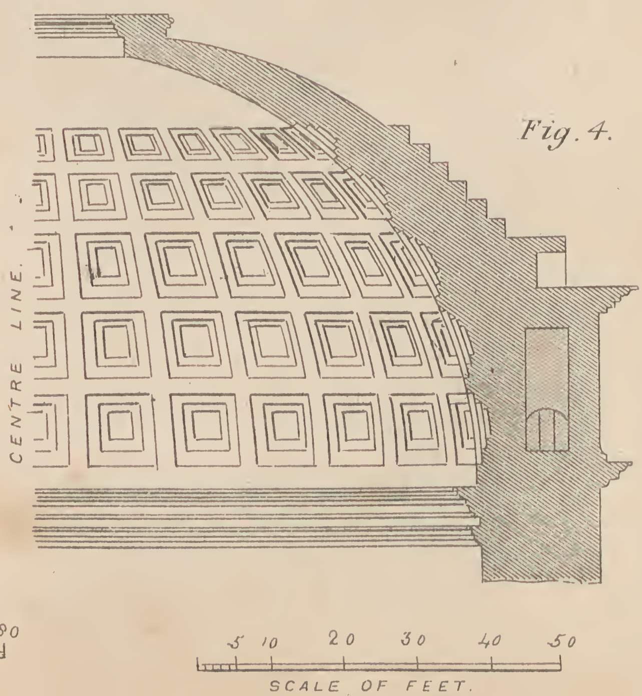


Fig. 2.

Fig. 3.

Fig. 4.



In *Plate* 5, Fig. 1, is a section through this double dome, showing its peculiar character, and the principal lines of its construction. A is the upper interior cornice, above which the spring of the dome begins. B B, are the windows, lighting the periphery of the tambour, and of which there are twelve in number. C C, the walls of the tambour, on the upper part of which the timber ribs and plates of the outer dome rest. D D, the point of spring of the upper stone dome. E, the opening or void in the crown of the lower, and F, the upper vault. Diameter of the first or lower dome at its springing, 80 feet. Height, to the soffit of the upper, 173 feet. The unusually large size of the opening in the lower dome, through which the one above is almost wholly visible, has been before remarked upon.

On the same plate are given the main lines of the dome of the Pantheon at Rome, with those of St. Peter's and the modern Pantheon, at Paris, the first-mentioned being the earliest, and the last the latest example of dome construction, properly so called.

In conclusion of these remarks on Domes, it may not be uninteresting, or without use, to append a tabular view, or comparison of the most considerable structures of the kind, recorded and existing; shewing the dates of their erection, their respective sizes, and the proportion of their points of support to the area contained in each, &c.

A COMPARATIVE TABLE OF DOMES.

Name and Place.	Interior Diam. at Spring of Dome.	Interior Height from Pavement to Summit.	Date of Erection.	Proportion of Points of Support to the Area.	Architect.
	ft. in.	ft. in.	A.D.		
Pantheon, Rome . . .	143 6	141 0	5	One-fourth	
Minerva Medica, Rome .	78 0	97 0			
Temple of Diana, Puzzuoli .	97 9	77 10			
Temple of Venus, Puzzuoli .	87 0	76 9			
Thermæ of Caracalla (circular saloon), Rome . .	112 0	116 3	217	One-sixth	
Ditto (octagon saloon), Rome	62 9	68 0	217		
Thermæ of Diocletian, Rome (now the Church of St. Bernardo)	74 0	83 0	302		
St. Martin della Rotunda, Ravenna (hollowed from a single block) . . .	36 6	60 9	530	. . . .	Aloisius, as assistant-architect.

A Comparative Table of Domes—*continued.*

Name and Place.	Interior Diam. at Spring of Dome.	Interior Height from Pavement to Summit.	Date of Erection.	Proportion of Points of Support to the Area.	Architect.
	ft. in.	ft. in.	A.D.		
St. Sophia, Constantinople .	112 0	201 8	537	Three-fourteenths	Anthemius, of Tralles, and Isodorus.
St. Vitale, Ravenna . .	55 0	91 0	547	Three-nineteenths	
St. Marco (central Dome), Venice	50 0	. .	984		
Ditto (smaller Domes) . .	35 0	. .	984		
Dome of Pisa	95 0	84 0 (to springing)	1150	. . . .	Diote Salvi.
Dome of Sienna . . .	57 6	148 0	1250		
Dome of Milan . . .	57 6	253 0	1426		
St. Maria del Fioré, Florence	138 6	310 0	1436	One-fifth . .	Philippo Brunelleschi. Lantern by Baccio d'Agnolo.
Capello di Medici, Florence .	91 9	199 6	1440		
Chiesa del Gesu, Rome .	53 3	151 6	1578		
St. Peter's, Rome . .	138 8	330 9	1580	·261 of whole area	Michael Angelo.
Madonna della Saluti, Venice	69 10	133 6	1640		
St. Andrea del Valle, Rome .	55 0	192 0	1607		
St. Agnese, Rome . .	56 6	158 6	1660		
St. Carlo al Corso, Rome .	50 0	186 7	1664		
St. Maria in Portico, Rome .	56 6	124 8	1665		
Baptistery, Florence . .	86 0	110 0	1700		
Invalides, Paris . . .	80 6	173 8	1704	. . . .	Commenced by Jules H. Mansart, continued by Robert de la Cotte.
St. Paul's, London . .	108 10	216 0	1710	One-sixth . .	Sir Christopher Wren.
Della Supergo, Turin . .	64 0	128 0	1731		
Pantheon (St. Geneviève), Paris	66 10	190 0	1790	One-seventh .	J. G. Soufflot.

CHAPTER VII.

ON GROINED VAULTING.

VAULTING, distinguishing it from the arch and dome, properly so called, may be primarily viewed as simple and compound.

Simple vaulting is an application of the ordinary arch, or vaulted principle, to a lengthened area, being simply an arched covering of greater or less length or continuance, spanning a more or less extended space. *Scientifically described, "a vault is simple when it is formed by the surface of some regular solid around one axis."†

Compound vaulting is formed by the intersection of arches in opposed directions, or, scientifically defined, "when compounded of more than one surface of the same solid, or of two different solids;"‡ the points of junction being technically called groins.

The semi-cylindrical appears to have been the earliest form of vaulting applied to a rectangular plan or area, both among the Romans—with whom the practice, properly viewed, is by general consent considered to have originated—and during the first period of the middle age. Later, in each case, the intersecting cylindrical, with other, and subsequently, more complicated forms were adopted, and a further development of the power and capabilities of the principle exhibited.

Of the first form, sometimes called the barrel and also the waggon vault, there are examples of Roman age in the subterranean conduit at Tusculum, near Rome, and in the Cloaca Maxima; two of the very earliest evidences. At Balbec, also, the main vault is cylindrical, pierced, after a prevalent fashion at a later period, with arches of lesser radius intersecting the main cylinder at right angles. §

Of mediæval date there are very many instances. The cylindrical vaulting of St. Martin's at Cologne, is a very interesting example. That of the nave of the chapel in the White Tower, London, || is another. At Sherborne Castle, Dorset, also, are remains of Norman barrel vaulting; and numerous other buildings of this age, both in this country and on the continent, might be mentioned as exhibiting its adoption.

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* Ware, in the Glossary of Terms prefixed to his *Complete Body of Architecture* (London, 1756), says:—*voce*, Arch, that the "arch and vault properly differ only in this, that the arch expresses a narrower, and the vault a broader piece of the same kind."

† Stuart's *Dictionary of Architecture*, Art. Vault. ‡ Ibid.

§ Ware's Observations on vaults; published in *Archæologia*, vol. xvii., p. 45. The vault here is 63 feet span, and 93 feet high. Ibid, p. 46.

|| A room under the chapel is also cylindrically vaulted. See Saunders' Observations on Gothic Architecture, in *Archæologia*, vol. xvii.

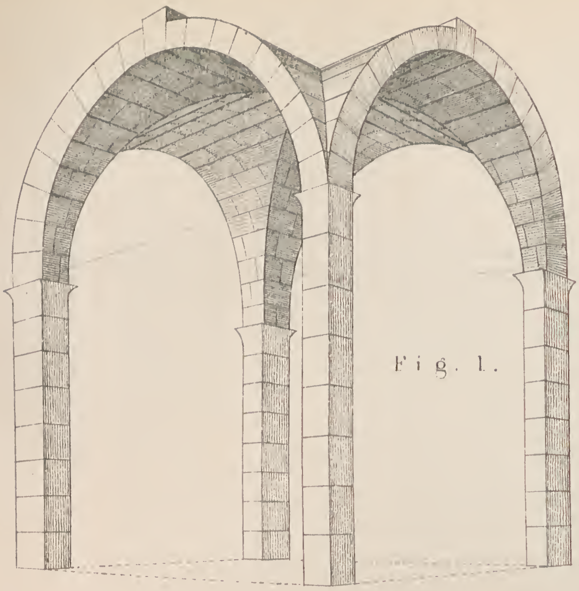
Of the next and most simple form of compound, or groined, vaulting, there are also some very, in point of dimension, magnificent Roman remains; among the number, the vaultings of the Thermæ of Caracalla, and the Temple of Peace, called by some the "Basilica of Maxentius," at Rome. The nave or central portion, of this latter edifice, is covered by an immense intersecting cylindrical vault, its span being 83 feet, and the height of the vaulting 121 feet. At the sides are other arches of nearly equal amplitude, being 80 feet span each, and 80 feet in depth. At the present time, three of these arches only remain on the north side, with portions of the springers of the central vault; the remainder of the original design having disappeared. The great central saloon of the Baths of Diocletian, 67 wide, 100 feet high, now used as a church, is also another instance of the intersecting cylindrical.

Both these examples exhibit a peculiarity observable, more or less, in all the Roman evidences of vaulting, where, as a general rule, the crowns and vaulting surfaces of the intersecting cylinders are of equal height and level throughout; an arrangement which has originated the term Roman vaulting, applied in more modern times to a similar form of construction. In *Plate* 5 *e*, *Fig*. 1, is a perspective representation of a cylindrical groin, in which the arches are of equal span and altitude, the intersections forming plain angular groins, after the common form of Roman and later round-arched vaulting. *Fig*. 3 is the plan of the same, and *Fig*. 5 a section taken through the centre, or on the line A B.

Fig. 2 is, in like manner, a perspective representation of a cylindrical vault, laterally pierced by arches of lesser radius, and consequent height. *Fig*. 4, is its plan, and *Fig*. 6, the section taken transversely, that is to say, on the line marked C D in the plan. In connexion with this section, *Fig*. 7, shows the mode of projecting the groins formed by the intersections of the smaller side arches with the main cylinder, the proper form and position of which are obtained by ordinates, in the manner shown by the dotted lines. *Fig*. 8, is simply a section through the crown of the main vault, or on the line E F.

Beyond this description or system of vaulting, varied in minor points occasionally, as at Balbec, before mentioned, by the introduction of smaller arches, proceeding from, and intersecting the main vaults at a lower level, similar to the representation given as *Fig*. 2, with its accompanying plan and section *Figs*. 4 and 6, &c., in *Plate* 5 *e*,—the Romans do not appear, judging by remaining evidence, to have extended their practice; and it is to the after period of the middle age, therefore, that we must have recourse for the more complex forms of groined vaulting. Both on the continent and in this country, the examples of this æra are very numerous and diversified. The early Norman groinings, as evidenced in either case, are retentions, in all essential particulars, of the ancient Roman, being copies severally and simply of the early cylindrical vault, and the later intersecting cylindrical groin. The simple Norman cylindrical or barrel-vault of the White Tower, and that of St. Martin at Cologne, have been already referred to. Of their groined vaulting there exists a number of very fine and perfect specimens. The first, or earlier, executed commonly in rubble, afterwards plastered on the under surface,* exhibit the plain angular groin at the diagonal inter-

* In the Temple of Peace, the vaulting is constructed in rubble, faced with tiles. The Norman vaulting at



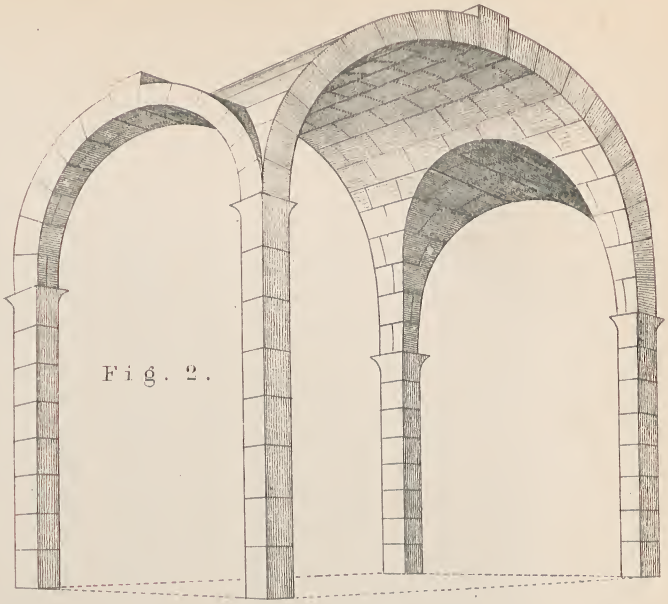
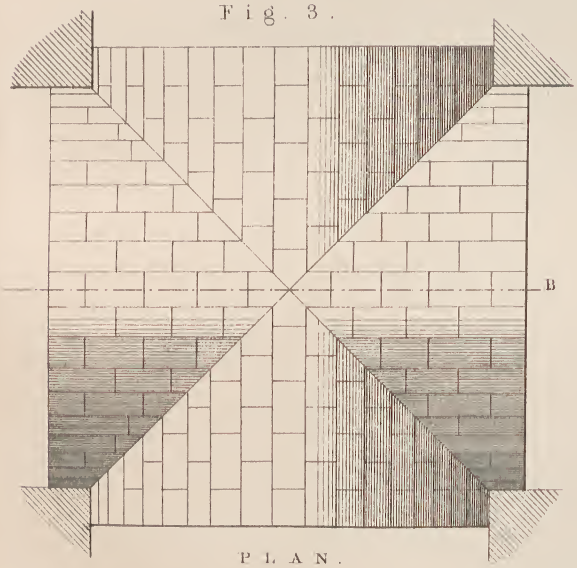
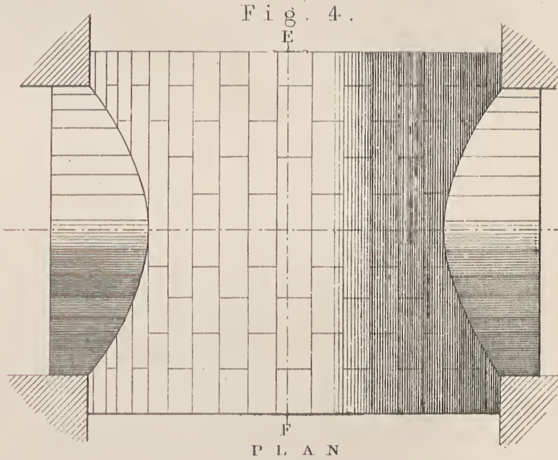


Fig. 3.



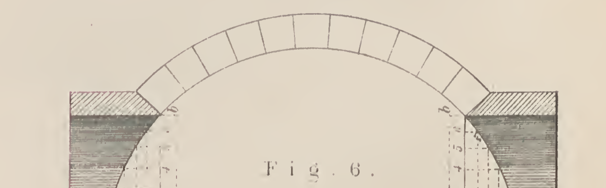
PLAN.

Fig. 4.

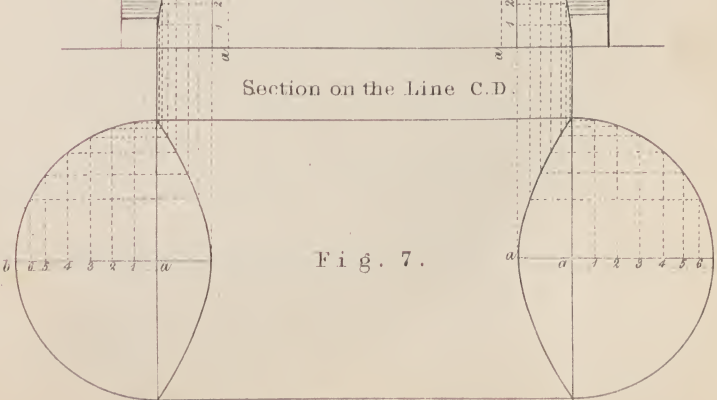


PLAN

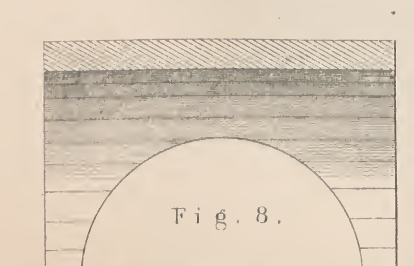
Section on the Line A.B.



Section on the Line C.D.

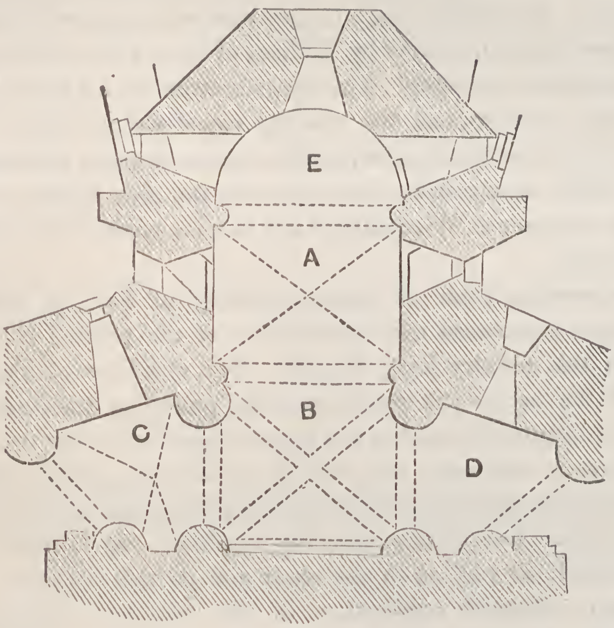


Projection of the Groins.



Section on the Line E.F.

sections, the rib, usually in the form of a plain broad band or arch in more or less projection of the vaulted surface, being confined to the transverse direction of the vault, or across, as from pier to pier, column to column, or other such-like opposite points of support.* Of this description are the groined vaultings of the crypts of St. Peter's Church, Oxford,† Canterbury choir, ‡ and the nave, or central portion, of the choir crypt at Gloucester. The original groining of the transept aisles at Winchester, erected 1079—1093, was also of this kind.§ At a later period diagonal ribs appear in addition, in some instances, as in the aisles of the crypt and the choir chapels, at Gloucester, of plain cut stone, corresponding with the earlier transverse ribs; and in others, as in the transept aisles of Christ Church, Oxford, of a few bold mouldings, the transverse rib still retaining its original character. The crypt of Gloucester shows, in one bay of the eastern chapel, the angular groin with the plain transverse stone-rib, (see A, in the annexed wood-cut,) and in the contiguous bay of the ambulatory B, the



Sherborne is of a similar character. The vaults of the crypts of Canterbury, and St. Peter's, Oxford, and those of the aisles of the chapel of the White Tower, are of rubble, with wrought stone transverse ribs. See Appendix A. to Observations on Gothic Architecture in *Archæologia* vol. xvii., p. 15, quoting Stow's *Survey of London*, p. 73, edit, 1618. In the transept at Winchester the groining is of rough random coursed stone, except for a short space above the springing-pieces, which are of cut stone.—*Ibid*, p. 16.

* In some groining at Sherborne Castle, the transverse rib is also omitted. See plates to *Oxford Glossary*.

† Date, the end of the 9th century. See Theobald's communications to the Antiquarian Society, *Archæologia*, vol. i., p. 151, quoted in Appendix to Observations, &c., above mentioned.

‡ Ibid.

§ See *Archæologia*, vol. xvii., p. 16, quoting Milner's *History of Winchester*, Edit, 1809. vol. ii., p. 11

diagonal cross-springer of similar kind in connexion with the same; the adjoining bays of the latter, C, and D, showing two forms of irregular groining, following the canted plan at this part. It also shows the semicircular apse, E,—a prevalent Norman feature. At Romsey, as at Christ Church, the moulded cross-springer occurs in connexion with the plain transverse arch, and there are a number of further instances. In other cases, the transverse rib was moulded to accord with the richer character given to the cross-springers, and frequently the whole were enriched with ornamentation. In the aisles of Peterborough, the transverse and diagonal ribs are formed of a bold round, within a square angle, and in many, the chevron and other forms of Norman enrichment are introduced.

In the preceding instances enumerated the cylindrical is the common vault exhibited. Later, or in what is called the the transitional Norman period, the introduction of the pointed arch created a corresponding variation in the vaulting forms. At Canterbury and Chichester are very curious and interesting evidences of the connected employment, and the progressive transition from the earlier round to the succeeding pointed form. The vaulting of the choir of the former church, erected by William of Sens, 1175—1178, is one of the earliest specimens of Norman pointed groining. The transverse ribs are all pointed, while the diagonal are, for the most part, circular, and the vaulting round-arched against the side walls. At Chichester, the vaulting of the transept has, in like manner, pointed transverse, and semicircular diagonal ribs. A similar arrangement also occurs in the aisle vaulting of the small building attached eastward to the choir at Winchester,* and in some vaults on the west side of the south transept at Peterborough.

The next or succeeding form of groined vaulting to the last mentioned, and which evidences the complete acceptance and introduction of the pointed character in vaulting, is that denominated in this country Early English. The character of Early English groining partakes of much of the nature and simplicity of the preceding transitional Norman. There is usually no ridge, or longitudinal rib, at the apex or junction of the two transverse curves of the vault. The diagonal, transverse, and wall-rib is, however, general, differing only from its Norman prototype in the lighter detail of its moulding, and a more regular and studied form. There is some fine Early English groining of simple character in the cloisters of Westminster, as well as in the choir and its side chapels. Salisbury exhibits a very complete and extended application of the simpler forms of Early English. In this instance there are cross-springers, and the transverse rib from pier to pier, but no longitudinal. Occasionally the longitudinal rib appears. *Plate* 6, gives an example of the first or plainer kind. The vault here shown, of which *Fig.* 1, exhibits the plan, has simply wall ribs, and groining or diagonal ribs, with a carved boss at the intersection of the latter. Very frequently, however, the boss was omitted, and the ribs mitred at their junction. A, *Fig.* 1, shows the plan taken at the springing of the ribs; B, is the plan taken through the shafts in the angles. *Fig.* 2 is a section through the centre of the vault, showing, at the same time, an elevation of it.

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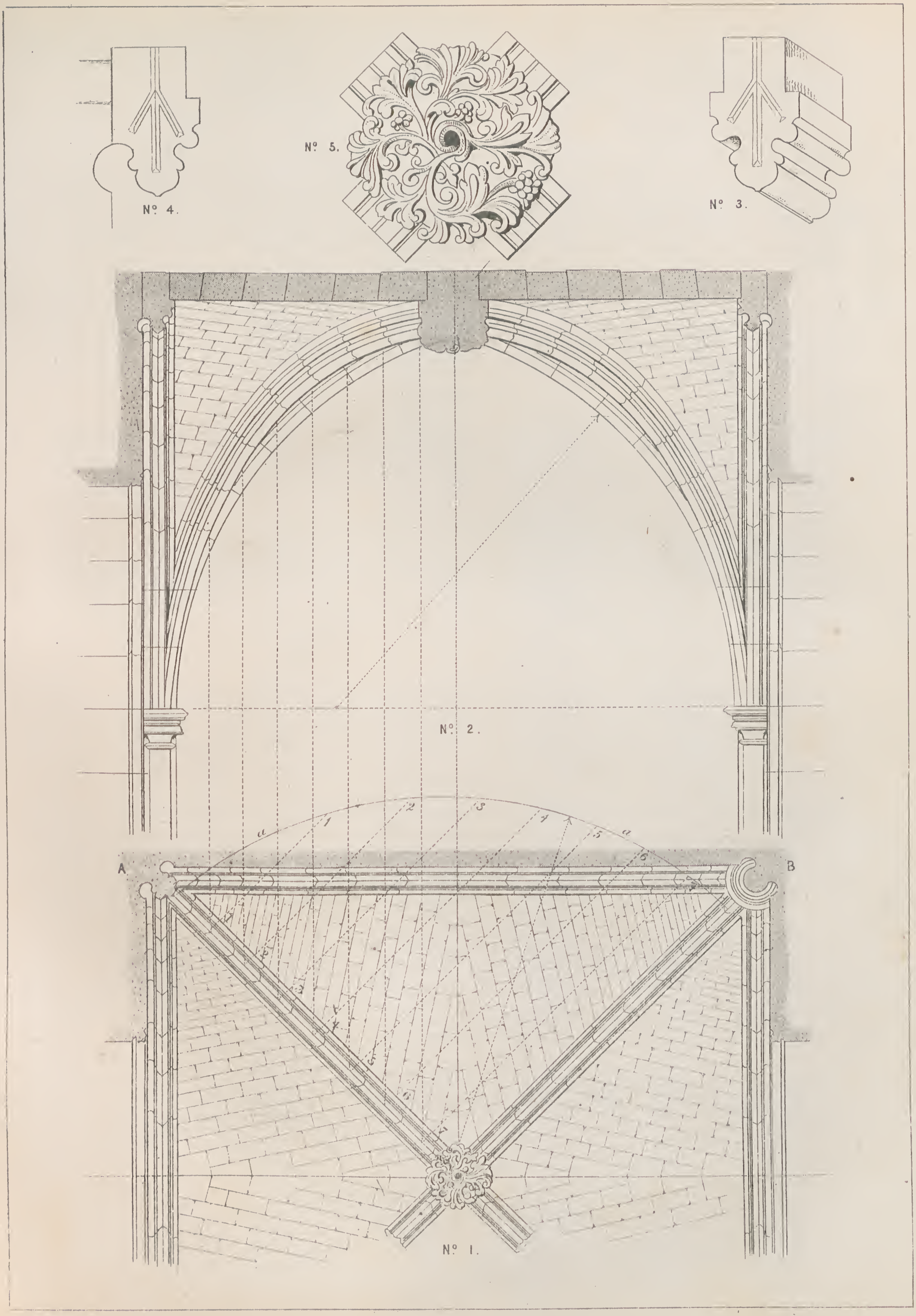
* *Archæologia*, vol. xvii., p. 24.


Nº 4.
Nº 5.
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A
B
a
1
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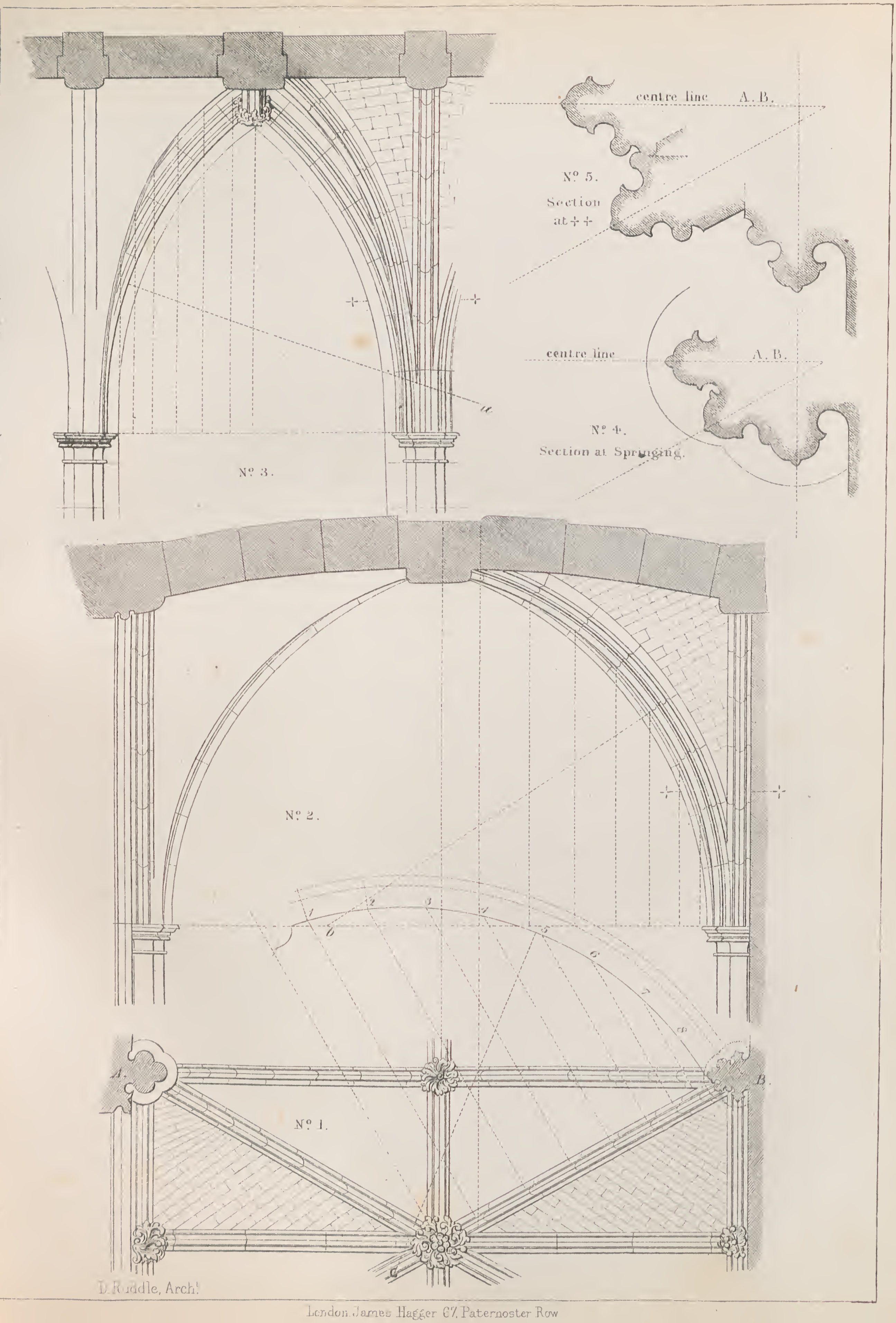
Nº 1.



D. Ruddle, Archt

The line *a a*, on the plan, exhibits the curvature of the diagonal, or groin rib, which is described from a centre a little below the springing-line of the vault. The orthographical projection of it is obtained by ordinates from the plan, numbered respectively 1, 2, 3, 4, 5, 6, 7, traced upwards to the section. Upon the lines thus produced, the heights, 1 1, 2 2, 3 3, &c., set up from the springing-line of the vault, will give the curve of the cross rib, as seen in elevation.

It is to be observed, that in some cases the cross, or groin ribs form a segmental, in others a semicircular, and sometimes a pointed arch, their centres being variously and accordingly situated. *Fig.* 3 is a section of the diagonal, and *Fig.* 4 of the wall rib to a larger scale. *Fig.* 5 is the boss at the intersection of the cross ribs, enlarged.

The beds or joints of the springers are most frequently horizontal. All those above the point where the ribs separate are worked to radiate; but in good work, all the joints should radiate to the proper centres.

The vaults are usually formed of stones, chalk in blocks, &c., from 3 inches to 5 or 6 inches in thickness and width, and are sometimes interspersed or banded with courses of stone of a different colour to the rest of the work, at regular intervals of four or five courses. In some cases, the spandrils between the ribs are constructed of rubble work and plastered, following the earlier Roman and Norman practices. Some of these plastered vaults have been decorated with painting: several examples show imitation lines of pointing in red colour. The crown stones of the vault are also sometimes ornamented with painted stars or flowers.

The next form of Early English vaulting is, that in which the horizontal with transverse ridge ribs were introduced, an example of which is given in *Plate* 6 *a*.

The plan here, differing from the last described, which was square, is parallelogramatic; with a view to show the treatment to be observed under such a difference between the length and breadth of the vault, and when an arch or opening in the lateral wall necessarily governs the height of the vault. *Fig.* 1, shows the half plan of one bay taken at A, as in the last example, through the shafts; and at B, through the mouldings at the springing, just above the caps. *Fig.* 2, is a section of the vault taken longitudinally through its centre. *Fig.* 3, is a section taken transversely, in which the lateral or narrower arch is shown somewhat stilted at the foot, and slightly depressed at the top; the longitudinal ridge rib being arched in consequence. This gives a domical contour to the vaulting, which is very prevalent in the foreign groining of the same age. The centre for the lateral, or transverse arch, is at some distance above the springing. The longitudinal arch, shown in *Fig.* 2, is struck from the centre *b*, on a line with the springing. The orthographical projection is obtained by ordinates, in the manner already described with reference to *Plate* 6. The longitudinal rib of the vault, being arched, is self-supporting; the joints radiating to the centre from which the curve is struck. The transverse ridge-rib, being level, is supported, until the spandrils are built, by the end joints being notched to the boss stones. *Fig.* 4, is an enlarged plan of the springing-stones of the ribs, with their respective sections shown complete thereon.

There is another description of Early English groining, noticed by Rickman, which has a second, or additional, rib between the cross-springers of the wall and pier ribs, a good

specimen of which, he says, exists in the groining of a passage leading from the cloisters at Chester. Another variety also occurs, according to this authority, at Lichfield, where the transverse, or pier, rib is omitted, the two intermediate ribs being brought closer together, and the longitudinal continued between them.

The Early English ribs are generally not so large as in the preceding transitional style, and consist, for the most part, of rounds and hollows, the latter frequently filled up with the toothed, or four-leaved, ornament of this period, as in the Lady Chapel at Salisbury. At Lichfield, the hollows are enriched with a leaf, and other kinds of ornament occasionally occur.

Some of the best examples of Early English groining in its different forms are to be found at York, Lincoln, Ely, Salisbury, Worcester, Westminister, and Durham, &c. The north porch, Wells Cathedral, has also a good specimen of plain Early English vaulting, that is to say, where the ribs are confined to wall, transverse, or pier, ribs, and cross springers, as they are throughout Salisbury. The groining of the Lady Chapel of St. Mary Overy, Southwark, is of the same kind; as is also that of the choir and aisles at Worcester,* the nave and its aisles at Wells, and the groining of the Chapter-house at Oxford, with that of part of the Lady Chapel at Winchester, and the aisles of the north and south transept at York.

The first alteration from the simpler groinings here mentioned, appears in the introduction, as before observed, of the longitudinal ridge ribs, with which was very shortly associated the transverse ridge rib, and, subsequently, other additional ones. Worcester Choir has the longitudinal rib in the main vault, the aisles, as just noticed, being without. The aisles of the nave have a transverse ridge rib, and no longitudinal; while the central vault has longitudinal and transverse, and, in addition, intermediate cross-ribs, after the fashion noticed by Rickman, as observable at Chester. The vaulting of the south transept of the nave has also longitudinal and transverse ridge-ribs, and short intermediate ribs from the wall and pier-ribs to the cross-springers. Ely Presbytery is of a more elaborated character, and the groining of the main vault of the south transept at York shows, in a similar manner, the very close approach to, if they are not actually of the date of, the fuller forms of the succeeding style.

Into description of the richer forms of Early English groining, here alluded to, it is, perhaps, unnecessary to enter, from their similarity generally to those of the Decorated Period which succeeded, Decorated groining, indeed, differing from the later Early English mainly in the increased number of the vaulting ribs, the less lofty sweep of the arches, the richer and more varied section of the mouldings, and the more extended adoption of the carved boss at their several intersections. Some of the earlier decorated roofs are, however, of comparatively plain character. These, for the most part, show the longitudinal and crossing, or transverse, rib at the apex of the arches, conjoined with the diagonal springers and pier rib, and the intermediate

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* Britton, in his *History and Antiquities of the Cathedral Church of Worcester*, gives the date of the vaulting of the choir and its transepts as 1376, that of the nave 1377, and that of the north aisle of the same 1327; but he refers to the groining of the Lady Chapel as being of the same kind, and similar to Salisbury.

one between the cross-springers and the pier and wall ribs, before noticed as sometimes occurring in Early English examples. A very good specimen of this, the plainer kind of Decorated roof, exists at Exeter Cathedral (date about 1360). The Choir of Selby Abbey Church, Yorkshire (1390), and the Lady Chapel at St. Albans (1326), are others; and a somewhat extensive further list might be added. York nave (1291 to 1330) and Chapter-house exhibit a richer description, as do several cœval erections.

In some of these latter, as well as in the richer roofs of a slightly subsequent date, ribs were introduced more fully, and in many instances crossing the vaults in directions opposed to their respective curves. This is commonly the case under the introduction of what are called lierne-ribs, where the patterns formed by the latter, and their consequent direction, necessarily interfere with the insertion of them in constructive accordance with the courses of the filling-in material. A number of examples might be enumerated shewing this peculiarity. One occurs in the groining at the entrance to the Chapter-house, from the cloisters, at Westminster;* and another, exactly similar in its plan, is exhibited in that of the cloisters generally at Worcester (1320).† See diagram *Fig.* 1; *Fig.* 2 (p. 52), being the groining of the

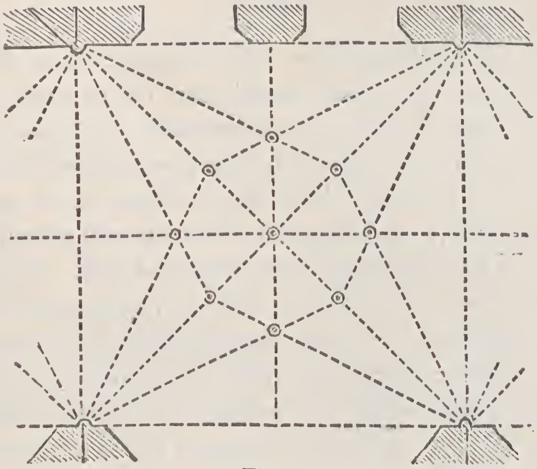

Fig. 1.

nave with that of the aisles of Worcester, exhibits the elementary, or first form of that shewn

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* The groining of the north aisle here is plain Early English, without ridge-ribs, having only cross-springers and pier-ribs. The same arrangement extends in the east aisle, or walk, to nearly the entrance to the Chapter-house, where the groining is of the more highly enriched description noticed in the text, having longitudinal and transverse ridge-ribs, diagonal and intermediate, and lierne-ribs, with very large and rich bosses. The part of the same aisle, south of the Chapter-house entrance, is again plainer, shewing longitudinal and transverse ridge-ribs, with diagonal, and pier-ribs only. The south and west aisles have ridge-ribs, both longitudinal and transverse, pier-ribs and cross springers, and intermediate ribs.

† Milner, in his *Treatise on the Ecclesiastical Architecture of England*, edit. 1835, p. 99, gives this as about the age of all the groining at Worcester.

in *Fig.* 1, and is of the same kind as the groining of the south and west aisles of cloister at Westminster, as described in note page 51.

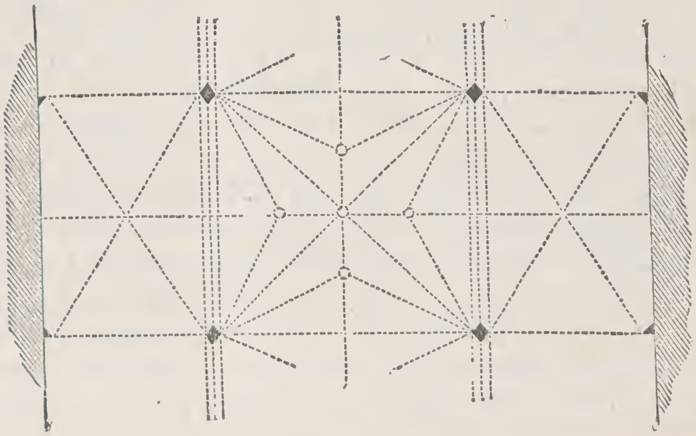

Fig. 2.

Both the above instances at Westminster and Worcester shew the simpler form of introduction of the lierne-rib, that is to say, of a single lierne rib, or where the pattern is produced by the one lierne only; of which there are several evidences. In York nave, before mentioned, and in other cases, the lierne-rib is more profusely displayed, and there are others, again, in which such, and other subordinate ribs, overlay the vaulted surfaces to far greater extent, and with reference to the filling-in vaulting, in an irrespective direction still more fully carried out. This is particularly the case in the later examples of the Decorated roof. York and Gloucester choirs (1361 and 1381) respectively, are very elaborate instances; other parts of the latter Church also exhibit a very extended introduction of the lierne and other subservient and ornamental ribs; as, at the west-end of the nave erected by Abbot Horton (about 1360), and in the north transept, of about the same age, where the patterns are of approximating character to the elaborateness of the later choir.* The Lady Chapel at Ely is a similar rich example of the same date, by prior John Wisbich.†

Elucidating, for practical purposes, the earlier and more limited admission of the lierne-rib, above referred to, and the simpler patterns generated thereby, *Plate* 6 *b* (*Figs.* 1 and 2) gives the plan and section of one-fourth, or quarter part, of a severy, or bay, of a Decorated groined vault, having the usual longitudinal and transverse ridge-ribs, cross-springers, and pier-ribs, with intermediate and lierne-ribs, introduced simply at the upper part of the vault; and in this

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* The nave groining, excepting the two bays at the west-end above referred to, is of the plainer form, having simply diagonal, wall, and pier-ribs, with ridge-rib only at the longitudinal apex of the vault. This latter vaulting is the work of Abbot Thokey (1237 to 1329). See Antiquarian Society's account of Gloucester Cathedral.

† Dallaway's *Discourses on Architecture*, London, 1833, p. 226, quoting Leland's *Collectanea*, vol. ii. p. 606.

GROINED VAULTS.—DECORATED.

PLATE 6b

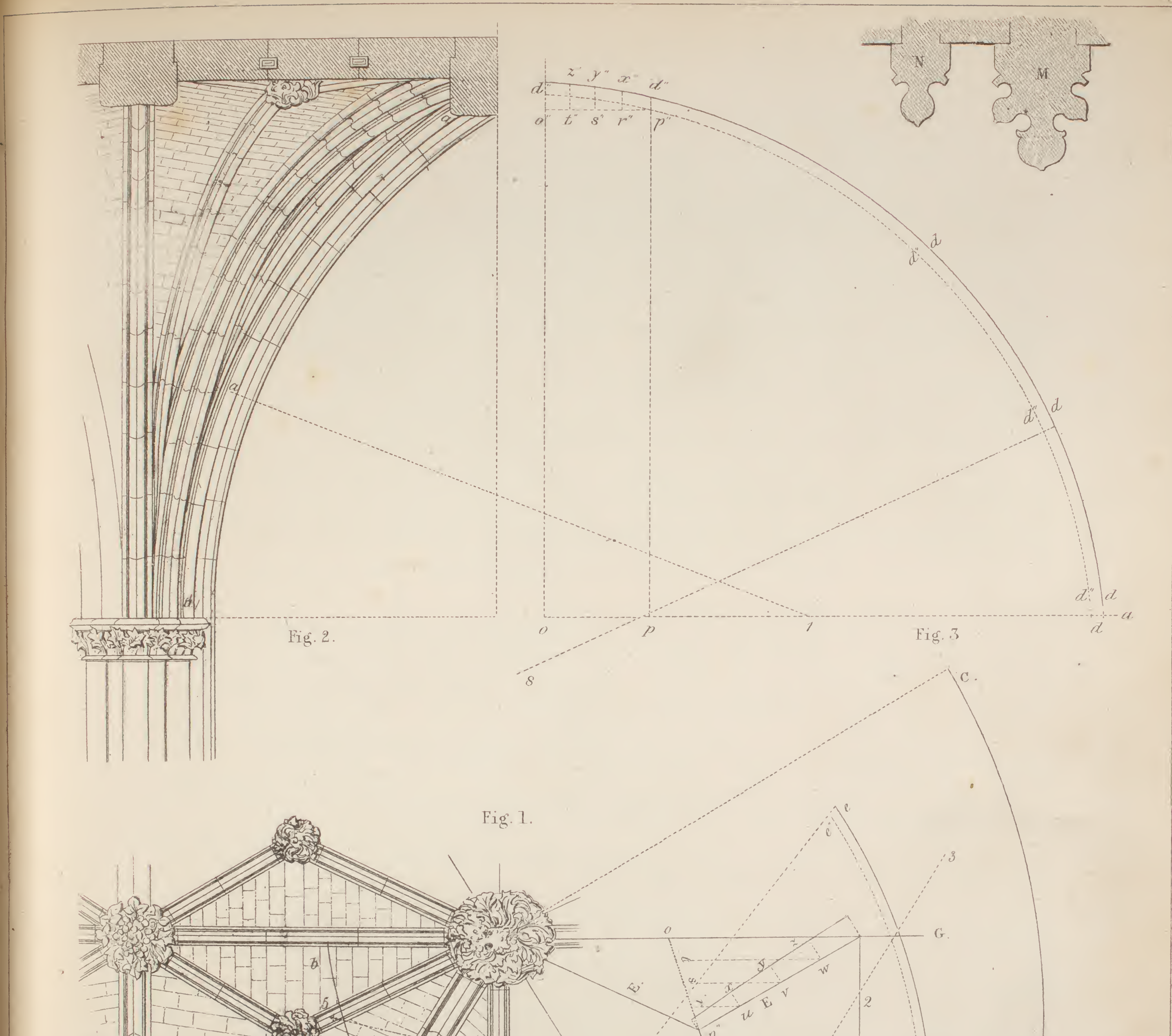


Fig. 2.

Fig. 3

Fig. 1.

T. Ruddle, Archt.

London. James Hagger 67, Paternoster Row.

instance as part of the vaulted construction—the more legitimate and better mode. It will be seen, on reference to the plan, that one of the intermediate ribs between the diagonal and the pier-rib, instead of continuing to and intersecting with the longitudinal ridge-rib, stops at its junction with the lierne, and thus forms one limb of the star-like pattern which, in the cases before mentioned at Westminster and Worcester, is perfected by the corresponding intermediate ribs between the diagonal and the wall-ribs on each side, also stopping short of the transverse ridge; and which, in the case of an equal-sided plan, or bay, of the same width as length, necessarily originates such pattern, as will be seen on reference to the plans of the groining of the Westminster and Worcester cloisters, given in diagram page 51. The other intermediate rib on the plan, or that between the wall-rib and cross-springer, is shewn continued to the transverse ridge, and is there finished, as are all the other junctions of the ribs, with an ornamental boss. On the adjoining one-fourth, or quarter plan, the elementary, or centre, lines of the ribs only are drawn, in order to shew more clearly the curves of the lierne in elevation.

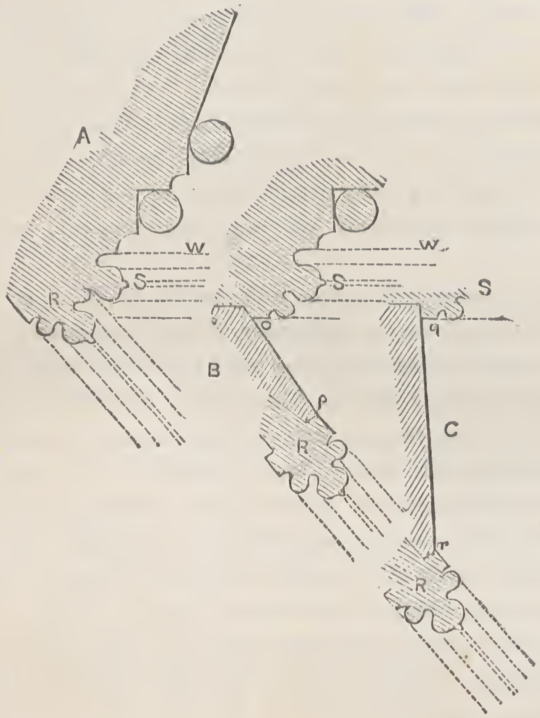
Constructively considered and projected, this vault has an acutely pointed arch *a, a, a*, *Fig.* 2, described from the centre marked 1, which governs the height of the vault; whilst the breadth in the other direction, or transversely, is much greater, being in the proportion of 3 to 2. The curve of the wider arch, or main transverse or pier-rib, A, is struck from two centres, 2 and 3, and is represented on the plan by the curve *b, b, b*. The diagonal-rib, or cross-springer, B, is also struck from two centres, 4 and 5, and is represented in like manner by the curve *c, c, c*. The section of the main ribs is given at M, and that of the ridge-rib G, and the smaller or intermediate ribs, at N. The curve of the latter, C, represented by *e, e*, is struck from the centres 9 and 10, the dotted line e'', e'', being correspondent to the edge of the main ribs. The intermediate rib, D, is given at *Fig.* 3, where *o, a*, is the springing, o, o'', a vertical line through the vault, *o*, on the plan, and p, p'', a vertical line through the intersection of the ribs at p''; and *o, d*, the distance *o, d*, on the line D in the plan. The dotted line d'', d'', corresponds in position, as in the case e'', e'', with the lower edge of the main ribs, and the space from d to d'' is the difference of height of the two ribs in section; *d, d, d*, being the curve of the rib struck from the centres 7 and 8. The curve of the lierne-rib E, is obtained by drawing a horizontal line p'', o'', *Fig.* 3, from the point where the curve of the superior, or main, rib would cut the vertical line *p*, at p''; or similarly from the point of intersection of the edge of the minor rib with the line *p*. Divide the line o'', p'', on the elevation, *Fig.* 3, and o, p'', on the plan, *Fig.* 1, respectively, into any corresponding number of parts, as r'', s'', t'', and *r, s, t*; then, by drawing lines *r u, s v, t w*, the line E on the plan will be divided into the same number of proportionate parts. Upon this line, as a base, from the points *u, v, w*, erect the perpendiculars *u x, v y, w z*, and set up on the elevation the correspondent heights, *v x, s y*, and *t z*, which will give the points through which to draw the curve of the edge of the lierne-rib, E. The curve of the other lierne-rib, E, may be obtained in a similar manner.

In roofs of the richer patterns and more complicated introduction of ribs, the principal and superior are projected upon the same principle as those in the plainer, just

described. The subordinate ornamental, lierne or otherwise, are, however, for the most part mere surface attachments to the vaulting, following and dependent necessarily upon its curve, but requiring and affording little or no constructive consideration or aid. They are matters chiefly of decoration, posited upon the pre-arranged and constructed forms of the vaulting. It will be unnecessary, therefore, to enter into more extended observation than has been already made, either upon the character or construction of this kind of roof. The intricacy and richness of appearance of the later examples, as contrasted with, and proceeding from the earlier types, has been shewn by reference to some of the most interesting and perfect of the former, and it will be sufficient, in concluding the consideration of Decorated vaulting, and before proceeding to a similar view of the Perpendicular style, to draw attention to a peculiarity which, applying to both Early English and Decorated vaulting, constitutes a feature unobservable, to the great loss of architectural effect and beauty in later work. In the Perpendicular, the groined surfaces are chiefly regular and correspondent in section; but in the two preceding styles, the varied shapes or curved direction of the filling-in vaulting between the ribs, is a source of effect and pleasurable sensation, artistically viewed, possessing considerable interest, and worthy the careful observation of the architectural student. The picturesque arrangement generally of the ribs at the springing of the groin; the manner in which the diagonal-ribs often intersect the wall-ribs (see *Plate* 6 *a*, No. 4), as compared with the more regular and tamer plans of the later period; the winding surfaces of the vaulting, produced by the different curvature of the ribs, which is in some cases very considerable, as where a window is inserted fully as large as the space enclosed by the wall-rib of the groin;—the sectional arrangement of the mouldings, the deep shadows of their hollows, and relieved light of their more prominent members, contrasting with the varying shades of the winding surfaces with which they come in connexion, form a combination in the highest degree effective, and far superior to the more studied and systematic arrangements exhibited at a later date. The annexed figure will show the nature of the peculiarity here referred to, as geometrically represented on plan (see following page). W. W. is the face of a wall in which is a window, the springing of the arch of which is considerably higher than that of the vaulting within and beneath which it is inserted. A, represents the plan of the jamb at the spring of the vault; B, represents the plan at a higher level, below the springing of the window opening; and C, the plan at a still higher point. R, is the diagonal rib of the groin, S the wall-rib; *o p*, shews the direction of the face of the spandril of the vault at the level B, and *q r*, the direction at the higher level. It will be seen that the course of the surface at *o p*, varies considerably from that at *q r*.

Arrived at the Perpendicular period, the general character and arrangements of the immediately preceding and more fully developed Decorated roof are still observable. The high form or elevated pitch of the vaulting is also in many instances still retained, though a more depressed sweep of the arch early became a distinguishing characteristic of the Perpendicular, with a similar full admission, and in numerous cases a largely increased application of ornamentation derived from the ribbed arrangements. Rickman observes that, "in the groined roofs of this style almost every variety of disposition of the ribs" is

apparent, the same being "increased in the later roofs, till the whole is one series of net-work." Canterbury nave (about 1431) is a very fine example of the earlier and less ornate



Perpendicular roof, and that of Westminster another. The richer specimens are exhibited at Gloucester, in the Lady Chapel, Oxford Choir, Ely, &c. &c.; and subsequently we have the fan-groined roof in all its different varieties.

There are no practical differences as respects the principle of the constructive modes employed, or apparently in the methods of projection made use of between the earlier Perpendicular groined roofs and those which they succeeded, until the last-mentioned phase of the former style approached. A more depressed form of the arch, as has been before observed, shows early in the style, and obtaining more and more, ultimately prevailed almost exclusively. In the later Perpendicular roofs of all kinds, the characteristic arch is, with few exceptions, the four-centred; but this does not appear to have created departure from the ribbed principle of construction previously and generally adopted, that is to say, of a main frame-work of ribs more or less numerous, and which has been described as a "skeleton of ribs filled-in with thin panels," until the extending complicated nature and excessive use of such introductions, both surface and otherwise, originated and necessitated the adoption of a more ready and practically convenient method of execution. The new mode consisted in the

formation of the vault as a work wholly of jointed stone—returning in a measure to classic practices—the panels being sunk or raised upon the under face, or solid soffit, of the vault, instead of being a filling-in of separate small pieces of stone, or such material, resting upon the ribbed construction. At first the new system appears to have been partially employed in connexion with the older practice, some specimens showing a portion executed in the ordinary ribbed manner, and other and more complex parts according to the latter plan. This is exemplified—according to the author of the valuable little work on the art of Masonry, published in Weale's rudimentary treatises, from which much useful information has been obtained, which is here willingly and fully acknowledged—in King's College, Cambridge, and there are several other edifices in which the same arrangement, or peculiarity, has been followed.

It is in the fan-vault, however, that the solid principle is most conspicuous, and the later vaultings of this kind appear to be generally, if not universally, so constructed. The examples of the fan-vault are very numerous, the most celebrated being those of Henry VII.'s Chapel, Westminster; King's College Chapel, Cambridge; St. George's Chapel, Windsor, &c. There are others of corresponding beauty and elaborateness of construction and ornament: Gloucester Cloisters, Peterborough Lady Chapel, Oxford Choir, St. Stephen's Cloisters, Westminster, all exhibit a fan arrangement of the most interesting character. Many of the small sepulchral chapels, in our cathedrals and other churches, also afford specimens in great variety. There are two in the Choir of St. Alban's, being the chantry chapels respectively of Abbot Ramrigge and Humphrey, Duke of Gloucester; and in those of Bishops Alcock and West, at the east end of the north and south aisles of the choir at Ely, as well as in Tewkesbury Abbey Church, are others. Indeed the list might be increased almost *ad infinitum.*

It may be observed that fan-tracery distinctively, though generally called fan-groining, has no groins, the grounds of the fanned portions exhibiting no change of vaulted surface, but being usually spherical on plan, representing inverted curvilinear conoids, of which the ribs—all of the same curvature and forming equal angles with each other—constitute, as in the preceding and coeval lierne arrangements, with their accompanying traceries, the decorative features only: the central part, or key space, of the vault forming what may be termed a quadrilateral curved-sided spandrel; which is generally segmentally domed in section, and sometimes filled with a large boss or with an inverted pendant. The Cloisters of St. Stephen's, at Westminster, before mentioned, exhibits a good example of the circular fan-groining here alluded to.

Of all the roofs of the fan description, however, that of Henry VII. Chapel is perhaps the most extraordinary and noticeable on the score of constructive science, and the intricacy of design displayed. Next to this and King's College Chapel, Cambridge, after the Gloucester Cloisters,*

* There is an effective perspective representation of the groining of these Cloisters among the plates of the *Oxford Glossary*, and a plan of the whole is given among the plates in the Antiquarian Society's *Account of Gloucester Cathedral.*

Rickman classes, as the best specimens, the Abbey Church of Bath, and the aisles of St. George's, Windsor. These are works on a large scale. There are smaller ones of the same kind, however, vying in all respects with the larger erections. The Chapel of Bishop West, at Ely, before alluded to, is a most exquisite instance among many others which might be adduced.

In the Westminster roof, among other peculiarities, the pendentives which form so frequently and so prominently a feature in the fan-groined roofs, are of unusually extended proportion, being, in reality, pendant fans from the arched construction of the roof, as distinguished from the more usual fan springing from the lateral or other points of support, formed by, or attached to, the enclosing walls. The same excess in proportion, with corresponding elongation or extent of depth, characterises the similar pendants in the roof of the Divinity School, at Oxford, where, says the authority above quoted, they " come down as low as the springing-line of the fans." * The roofs here mentioned are probably unique in both the respects referred to, and evince that desire of creating difficulties for the purpose of overcoming them, which would appear from many of their works to have been the great object and pleasure of the later builders in this style.†

Of the fan and of a very usual other kind of the Perpendicular roof, it is proposed to give engraved illustration, in the same way as has already been done with reference to the Early English and Decorated; but previously to doing this it may be proper to briefly notice another description of roof occasionally introduced, most frequently in smaller works, such as sepulchral chapels, like that of Abbot Wheathamstead, at St. Alban's, and more minutely in monuments and screen-work; but sometimes in larger works, as in the nave of Bath Abbey Church, and the entrance to Henry VII.'s Chapel from the Ambulatory, at Westminster. This roof is hardly, however, a groined-roof, though partaking, in a measure, of its appearance. Rickman describes it as "an arch roof, flat, and composed of a series of small rich panels, with a few large ones at the centre of the compartments formed by the piers; " and he refers to the roofs of the small chapels attached to the Beauchamp Chapel, at Warwick, in addition to the porch of Henry VII.'s Chapel, just mentioned, as good examples.

On the methods executively followed in the construction of all these roofs, it may be necessary also previously to add a few observations to those already made, founded upon the valuable contributions to our knowledge on this point, of Saunders ‡ and Ware, § published in *Archæologia*, vol. xvii., and of Professor Willis || and Dr. Whewell, ¶ referred to in the rudimentary Treatise of Mr. Dobson, before mentioned, as well as those communicated in that work

* See Rickman's *Attempt, &c.*, p. 103, Edit. 1835. The termination of one of these pendants, and of those at Westminster, is given in the *Oxford Glossary*. See the illustrations to Art. Pendant, plate 101.

† This is particularly exemplified in several of the lierne vaultings abroad.

‡ "Observations on Gothic Architecture."—*Archæologia*, vol. xvii.

§ "Observations on Vaults."—*Ibid.*

|| Paper " On the Construction of the Vaults of the Middle Ages," published in *Transactions of the Institute of British Architects*, and " Remarks on the Architecture of the Middle Ages, especially in Italy."

¶ Architectural Notes on German Churches.

itself, with a view to the uses of the artizan in carrying out such works. Incidentally, in the description of their distinctive features and appearances, a certain amount of remark has necessarily been made, but it may not be altogether uncalled for or unserviceable to enlarge upon the point, giving to the further observations introduced a somewhat more distinct and practically guiding character.

In the classic, or Roman, and other cylindrical groinings, very simple modes of execution were employed. The "method of finding the proportion of a groin by ordinates, from the square section of the principal vault, does not appear," says Mr. Dobson, "to have been known, or at all events practised, by the Romans, the irregularities of the groin lines of Roman vaults indicating that they were built in a manner similar to that even now frequently adopted; that is to say, by forming a perfect centre for the principal, or main, direction of the vault, and placing the centering for the transverse, or cross, vault upon the former, by which the groins are shaped out and formed in the progress of the work. It is probable that even in the larger Roman vaultings an equally simple principle of operation was practised. The vaults of the Baths of Dioclesian and Caracalla shew evidences of it in the waving line of their groins, which, says Mr. Dobson, is a consequence of the non-intersection of their vaulting surfaces in vertical planes, occasioned by the sections of both vaults being semi-circles of different radii; the lesser being stilted at the springing, to bring the curves level. In the earlier Norman cylindrical groined vaults this was evidently the plan pursued, as is indicated by the marks of the boarding which covered the centering, being in some instances still visible on the soffits of the arches. Mr. Saunders notices this as being the case on the vaulting of a room under the chapel in the White Tower, London.

There is no doubt but that this is an easy mode of obviating, or rather getting over, the difficulty attendant upon a more scientific mode of procedure, but it has the disadvantage of causing weakness at the groins where strength is necessary in works of large span. This appears to have been early felt, and to have shown itself in many of the Norman vaults, where the defect has been sought to be remedied by the after-addition of ribs for support at these parts. Saunders notices, that the original groining of the transepts at Winchester, built 1079—1093, was constructed upon the old principle, and without cross-ribs,* which were subsequently added to render the groins secure. The ribs in the vaulting of the aisles at Romsey Abbey Church are also, he says, "evidently subsequent additions."

In this system, which may be termed the solid, as distinguished from the next subsequent practice, the vaulting surfaces were first constructed; the ribs, where introduced, as afterwards became common, being made to follow, or subservient, to the course or shape of the groins. In the later groinings the reverse of this is the plan pursued. Here the ribs are first designed and erected, and the vaulting intermediately filled-in and accommodated to each respectively. This is called by Professor Willis "rib and panel work," and became the common system until the revival of the solid vaultings of the later perpendicular era.

Some few roofs of Early English date, it may be observed, however, have less the true

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* In this instance the groins commence with cut-stone at the springing, but quickly run into random-coursed work in the more usual manner.

character of the ribbed construction than the later ones, the filling-in being simply laid, as it were, upon the ribs, and constructively continued over them, the latter merely acting as underlying supports. Examples of this, however, are not frequent, and they probably show, considered generally, only the transitional form of the after-introduced or added-ribs just noticed. At Chichester, the vaulting under the central tower shows this process in a character rather, perhaps, more systematic. "The shell of the vaulting here," says Mr. Saunders, "is finished, but only the springing of the ribs exist, " apparently inserted in the walls of the Tower, and forming one solid mass with that part of the shell; the diagonal angles of which are flattened to receive the diagonal-ribs, which have, however, never been erected; the work remaining incomplete and as left by the original constructors.

The first introduction of the rib on the strictly new principle appears to have been attended with a difficulty which very imperfect means seem to have been adopted to overcome. Mr. Dobson says the first diagonal-ribs were either semicircular or segmental, and in either case the transverse and longitudinal-ribs being cylindrical, with the intersections of their vaulting surfaces rising considerably above the diagonal-ribs at the haunches, it became necessary, and was a common practice, to back up upon the latter to meet the vaulting, and he gives an illustration, shewing how this backing up appears in the case of a segmental cross-springer; adding, that an example of the semicircular-diagonal, with stilted transverse and longitudinal-ribs, so as to accommodate the common level of the crowns of the arch of each, occurs, in a vaulted apartment of the Castle, at Newcastle-upon-Tyne, and of the second or segmental in the aisles of the Nave at Peterborough. Later, with the semicircular-diagonal, the transverse-ribs instead of being stilted semi-cylindrical, were constructed in the pointed form, which afterwards superseded entirely the older kind.

In the earlier pointed vaultings of the ribbed description, the crowns, or ridges, of the main and intersecting vaults are still, in the majority of instances, as in the older barrel or cylindrical constructions, kept at the same level, and horizontal, being generally without other than wall and pier, and diagonal, or cross-springing, ribs. In some, however, as at Salisbury, they are to a considerable extent domical, as the similar groinings of the continent very largely are, and as sometimes occurs in the somewhat later English groinings where the ridge-rib is introduced, and very commonly in the pendant and fan-groined roofs of the later perpendicular age.

In the level or horizontally-laid ridge, where the ridge-rib is omitted, the key or ridge courses of stone, &c., are racked-shaped, and derive support from the abutting vaulting courses, and a lodgment on the wall-ribs and the centre bosses or mitre junctions, as the case may be, of the cross-springers; such racked form being "occasioned," remarks Mr. Ware, "by the positing of the stones forming these courses" "between the ribs, which, instead of being parellel to the plan, as in Roman groined vaults, take a mean direction between the groined-rib, and the ribs of the arches over the sides, whence they meet the vortex at an acute angle;" a method which, originating in the position of the ribs at the springing, has, he adds, the advantage of requiring less centering in their construction. Under the employment of the ridge-rib, the several stones of which the same is composed are formed, necessarily in many cases, to radiate, and to constitute an arched construction of greater or less curve. The

groining at Lincoln is referred to * as exhibiting a striking example of the curved ridge-rib, and others might be added. Sometimes the arched and level ridge-rib occur together, the longitudinal forming a series of small flat arches from boss to boss, the transverse being built straight, according as the frequency of the intermediate ribs may allow.

The mode of projecting a plain Early English ribbed vault, with ridge-ribs, is shewn in *Plate* 6, the explanation of which will be found in the text at pages 48 and 49, and the like mode of projection in the case of one with horizontal or level transverse ridge-ribs and curved longitudinal, in *Plate* 6 *a*, the description of which is given at page 49. The similar proceedings in the cases of the Decorated, and the ordinary and later perpendicular, are also given in *Plates* 6*b*, 6*c*, 6*d*, and 6*e*, their respective explanations being given at pages 52, 62 and 63.

In all but the last-mentioned of these, it is to be remarked that the principle of proceeding seems to have been—having determined the height of the vault—to set up the several ribs, according to the nature and character of the design, each, as Mr. Dobson observes, "without any immediate reference to the curvature of the adjoining ones;" and afterwards to fill in and adjust the vaulted surfaces† to them, according to their respective forms and direction. This plan, as before noticed, causes considerable variety in the curves of this filling-in, some being of very concave section, others less so, and the different form in this respect originates, as previously remarked upon in another place, a very pleasing effect in the combinations of many of the groinings of the later Early English and Decorated periods.

In the perpendicular groinings, especially of the later date, this arrangement of the surfaces of the several compartments seems to have been less considered, the latter having reference more particularly to the main-ribs, and being governed more exclusively and generally thereby; and as the style approached the fan period, this appears to be more and more the case. Many of the later perpendicular are, indeed, very simple and regular groins in reality, arranged and erected upon this principle, though the profuse introduction of ribs gives a contrary and complicated appearance to them, not actually existing in the fact, or the *modus operandi* of their construction. In the still later, or fan-vaults, this regularity is yet further, indeed, completely carried out. In the fan-vault, says Mr. Dobson, "all the main-ribs are of the same curvature, and the angles they form with each other are equal." Their plan is also regular, and "may be conceived to be composed," observes Mr. Ware, "of the four quadrants of an inverted concave conoid; the base being a circle inscribed in the plan, by which the curvature of each rib is of the same genesis."‡

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* See Weale's *Rudimentary Treatise*, before referred to, p. 111.

† Sometimes the filling is of rubble plastered, most frequently, however, of coursed stone, chalk, &c. In some Early English and Decorated vaults, the chalk is alternated at intervals with courses of stone, as bandings, varying very effectively by difference in colour, the appearance. Generally the thickness of the courses, as noticed in the description of Plate 6, (see page 49), is about 4 or 5 inches. Occasionally slab-stone is used, scribed to, and resting on the rebate of the ribs.

‡ Mr. Ware further distinguishes these and a similar class of vaults as, "ribbed vaults by ribs of the same curvature," in which, he says, the advantages "peculiar to the different kinds of vaulting were concentrated" while "the simplicity of their construction," he adds, "may vie with the original cylindrical vault."

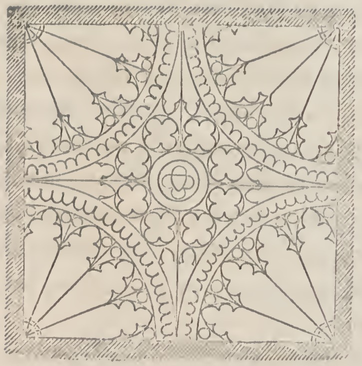


Fig. 1.

This, in the case of a rectangular equal-sided area, exhibits in plan, the arrangement shown in the annexed wood-cut, *Fig.* 1, representing the groined roof of the Porch at Cowdray House, in Sussex; and in oblong or parellelogramatic plans, a semicircular condition of the fans, as in *Fig.* 2, showing the groining of the Cloisters at Gloucester; or intersected quadrant-fans, that is to say, fans in which the arcs intersect each other before the quadrant of the circle is completed, as in *Fig.* 3, which shows a compartment, or bay, of the groining of King's

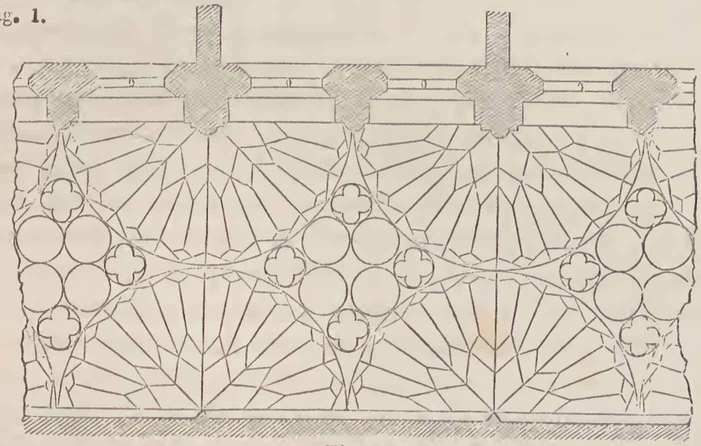


Fig. 2.

College Chapel, Cambridge. Lierne-ribs where introduced in either case—carrying on the regularity of disposition in the parts—are horizontal, and a section of the fan is relatively the same, the ribs of its formation being equal arcs of the same curve, taken at any level in such direction; as it is also in the case of the perfected quadrant or semicircular fan, vertically, in the direction or line of the radius.

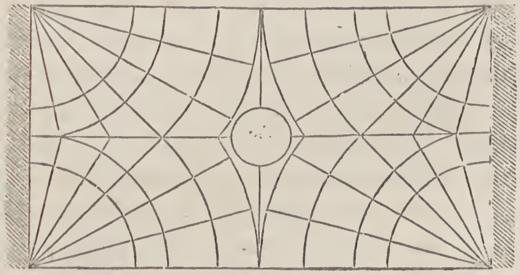


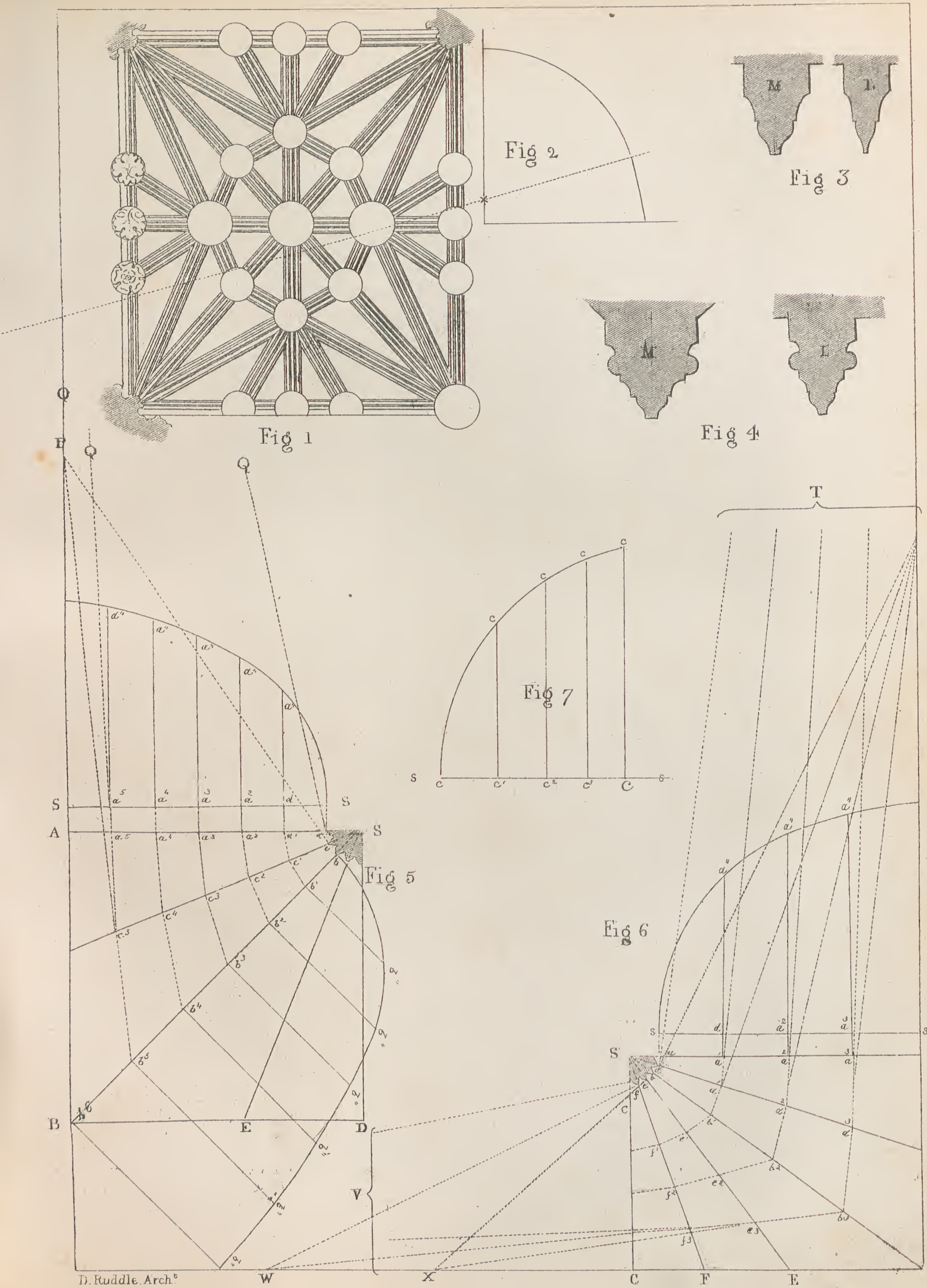
Fig. 3.

In *Plates* 6*c*, 6*d*, and 6*e*, detailed reference to which as engraved illustrations proposed, was deferred for the purpose of adding previously, the further remarks just offered on the methods of execution followed in such works, and to which, such further observation being concluded, return is now made, the peculiar characteristics, constructively and otherwise, of both the kinds of roof last alluded to, are fully exemplified. The first, *Plate* 6*c*, shows the plan of one compartment of a perpendicular roof of the ordinary late form, the arch being four-centred, or ellipsoidal, and the ribbed arrangements regular geometric patterns or figures; and at the same time a mode of orthographically projecting the curves of such a roof on the principle that all the different surfaces of a vault are conoidal; a principle that will be found to give

pleasing result where symmetry is required, and a strict adherence to the ancient forms is not desired. It will also be found useful in guiding to the proper forms of the ribs, when the ancient system is intended to be followed. The second, *Plate 6d*, shows two plans taken at different levels, of a portion of the fan-groined vaulting of the Chapel, at the eastend of Peterborough Cathedral, in one of which the ribbed and traceried arrangement is pourtrayed, as viewed from below, and in the other the constructive formation as seen from above, that is to say, looking on the crown, or upper surface of the fan. The third, *Plate 6e*, shews an elevation of a fan of the same roof, with a section, taken through its centre, exhibiting in the lower, or springing portions of the main-ribs, the rib and panel, and in the upper, the jointed-stone construction usual in the more complex fan-groins.

In the first-mentioned *Plate*, 6c, *Fig.* 1, is the plan of the groining, showing a very common form of the ribbed arrangement. *Fig.* 2, shows the curve of the transverse rib. *Fig.* 5, represents the quarter plan, S A B D of a similar groin, but of equal sides, where AB, BD, are the centre lines of the vault; AS, and SD, the wall-ribs; SB, the diagonal-rib; CS, and ES, intermediate-ribs; *a c b* at S, the springing of the edge of the rib, and a'', a'', a'', a'', a'', the given curve of which, *a*, on the plan is the seat; the ridge being taken, it is to be observed, as level. To project the other ribs draw the centre line AB, indefinitely to Q; produce *c a* at S, until it intersects the centre line AQ, at Q, and divide the seat line of the rib A *a*, into any number of parts; then, from the point Q, through a^1, a^2, a^3, a^4, and a^5, draw the lines Q a^1 c^1, Q a^2 c^2, Q a^3 c^3, and so on. Produce *b c* at the springing S, till it cuts the centre line of the vault at P, and draw from the point P, the dotted lines P c^1, P c^2, P c^3, &c., &c. Let *s s* represent the springing-line of the given arch or rib, a'', $a_{\prime\prime}$; draw perpendicular to it to the lines a^1 a'', a^2 a'', a^3 a'', a^4 a'', a^5 a'', until they cut the arch line. Erect on the line *b* B, on the plan, the perpendiculars b^1 b'', b^2 $b_{\prime\prime}$, &c., &c., and set at the same heights, that is to say, the heights, a^1 a'', *a* a'', &c., at b^1 b'', b_2 b'', &c., and these points will give the curve of the diagonal, or cross-rib, B *b*. The curve of the other rib C, may be found in the same manner; and the groin being square on the plan, will have the other side, S B D, exactly the same as S A B.

Fig. 6, represents the plan of a groin of an oblong form, or where the length differs from the breadth, S A B C; AB, BC, being the centre-lines of the vault; AS, SC, the wall-ribs; SB, the diagonal; SD, SE, and SF, the intermediate-ribs; and *a*, *d*, *b*, *e*, *f*, *c*, at S, the springing of the edge of the ribs; a'', a'', a'', being the given curve, and *s s*, the springing line. The principle of obtaining the curves is the same as in the preceding *Fig.* 5, but the vault having unequal sides, the projection has to be continued to the other portion of the plan S, B, C; the lines, b^1, e^1, b^2, e^2, b^3, e^3 being produced to X, e^1 f^1, e_2 f^2, e^3 f^3, to W, and f^1 c^1, f^2 c^2, f^3 c^3, to V. *Fig.* 7, is the curve of the rib *c* C, on plan, produced by the same method as the diagonal-rib in *Fig.* 5. The sectional cuts marked M and I, *Figs.* 3 and 4, are those of main and intermediate-ribs of the late perpendicular period, which it was often the custom to vary in size, as respects breadth, the depth in many cases being kept the same. They would apply to *Fig.* 1, or to other similar roofs.



D. Ruddle. Archt.

Fig. 1. Fig. 2.

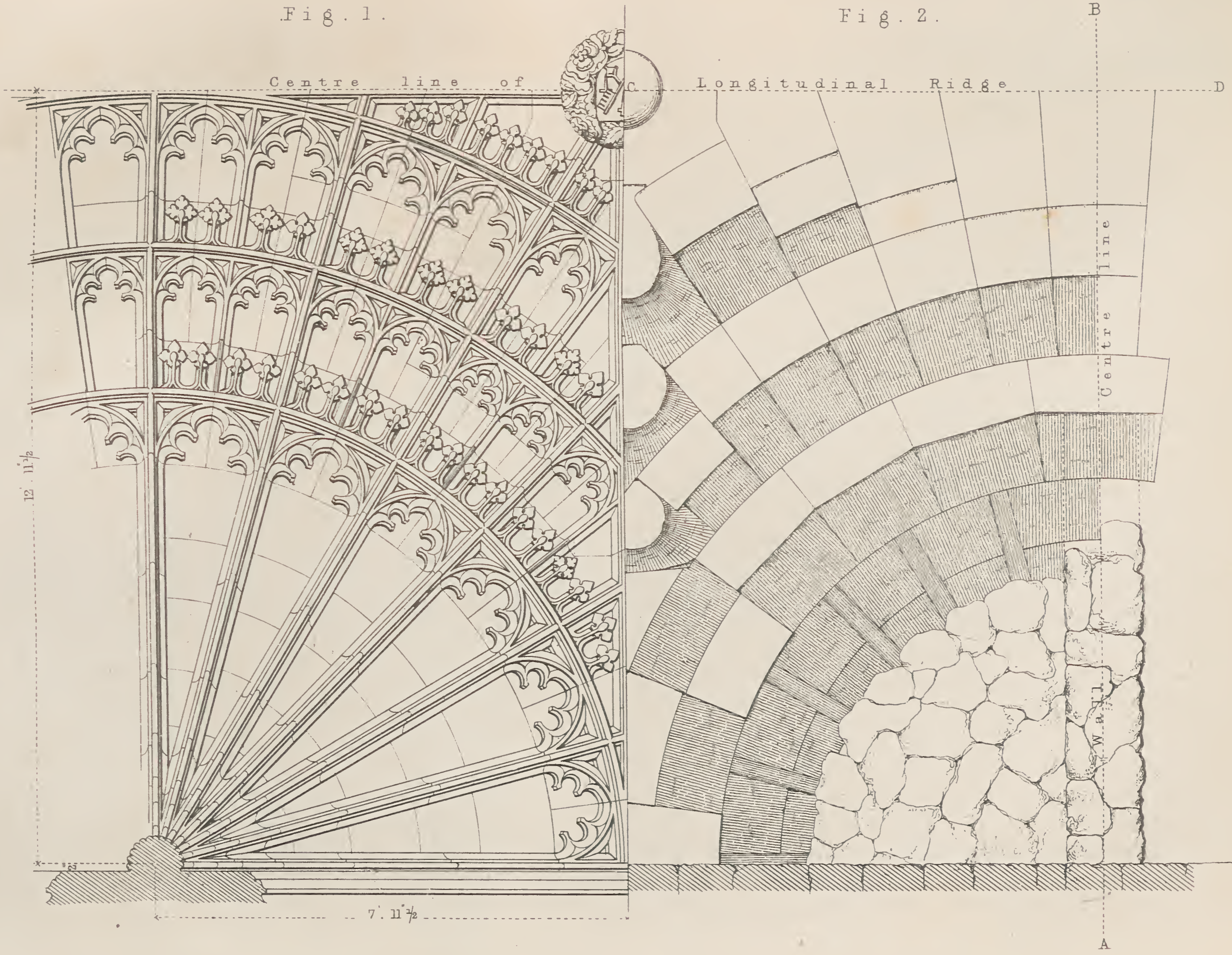
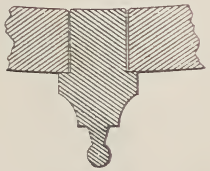


Fig. 4.

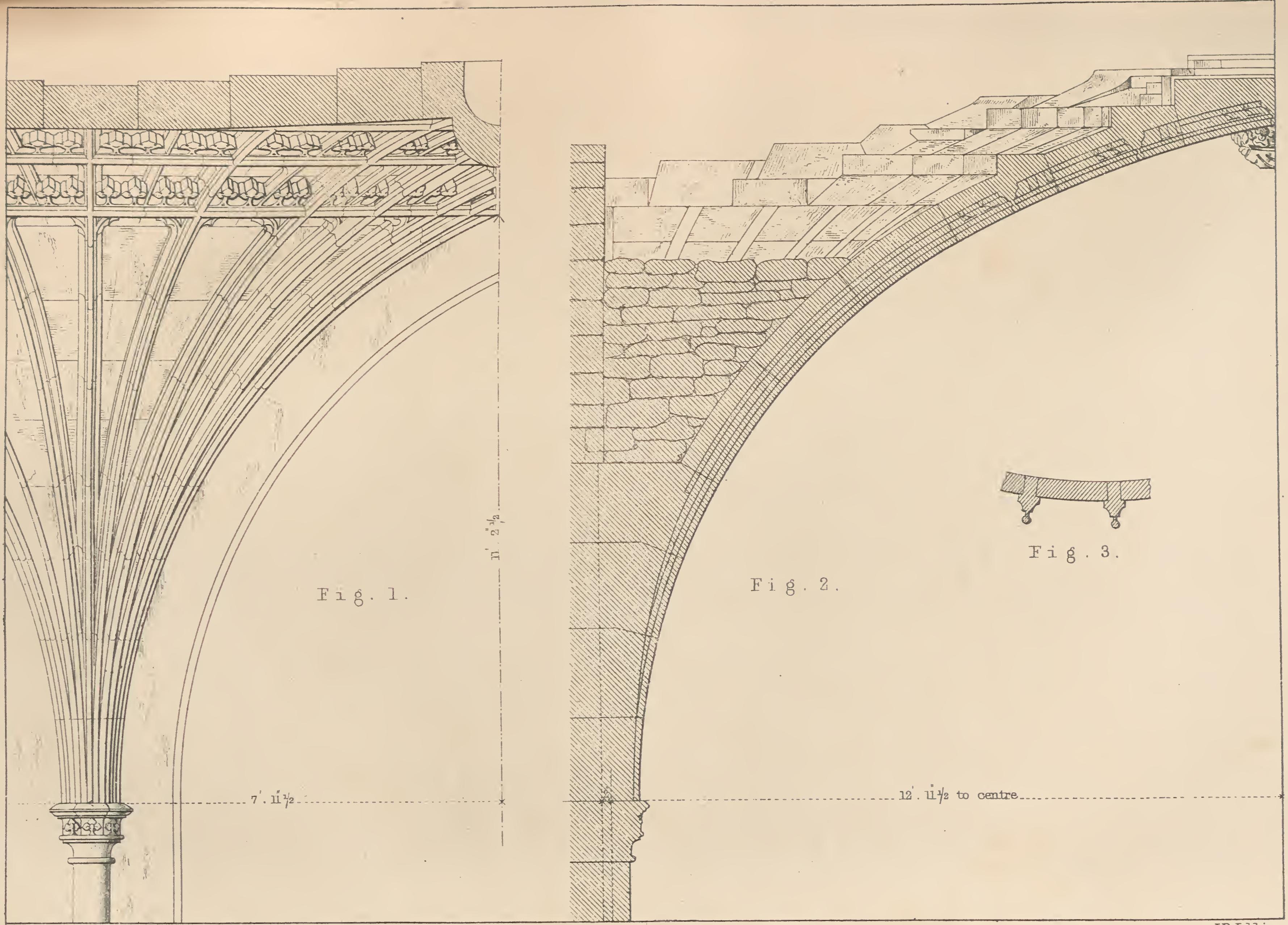
Fig. 3.



Measured & Drawn by D. Ruddle, Archt.

J.R.Jobbins

London. James Hagger. 67 Paternoster Row.



Measured & Drawn by D. Ruddle, Archt.

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The second *Plate*, 6*d*, is an illustration of fan-vaulting, taken, as previously stated, from the Chapel at the east end of Peterborough Cathedral; of which the main portion consists of five severies or bays, oblong in plan, the transverse-rib being to the longitudinal in each, as three to five. The continuation of the vaulting on the south side, to the end of the aisles of the choir, consists of two square compartments, and that on the north side is the same.

The quadrants or fans are not separated from each other by a main-rib, as in some examples, but the transverse-ribs are of the same size and section as the other ribs, so that the quadrants form together a portion of an inverted concave parabolic conoid; the surface of each being divided into six compartments by vertical-ribs, all of the same curvature, one of the principal features, as already observed, of this description of groining. These compartments are not all equal, the one between A and B, on the plan, *Plate* 6*f*, occupying a similar position to the corresponding ones in the square vaults, while the diagonal-rib is directed to the intersection of the transverse and longitudinal ridges of the oblong vaults. The vertical-ribs are crossed, or intersected, as is commonly the case in fan-groining, by horizontal ribs, the square vaults having one at the level of the lowest point of the ridge, forming a semicircle, and the oblong vaults, in addition to this, two others, one at the level of the highest point of the ridge, and one between the higher and lower, dividing the intermediate space into two nearly equal parts. The arrangement of the tracery and ornamentation of the panelling of the compartments, as well as the jointing of the masonry, will be readily seen from the plates, which are drawn from careful measurements and investigation, the leading dimensions being added.

Fig. 1 on the Plate, gives the plan of one quarter of the severy, showing the under surface of the groining, and *Fig.* 2 a plan of the upper surface of the adjoining and corresponding portion, in which the shaded parts indicate the inclined surfaces, and the unshaded the surface of operation; upon which the original lines of the setting out still remain, though they are here omitted to save confusion. *Fig.* 3 is an enlarged section of the rib; and *Fig.* 4 is a section of the capital of the vaulting-shaft.

In the third, or last-mentioned, Plate, viz., 6*e*, *Fig.* 1 is a section through the longitudinal ridge from C to D, on the plan given in *Plate* 6*d*, showing, at the same time, an elevation of the quarter bay, and the upper part of its vaulting-shaft. *Fig.* 2 is a section through the centre of the vaulting-shaft on the line A B, on the same plan, exhibiting also an elevation of the upper surface of the groin and the transverse-ridge; from which it will be seen that the lower portion of the vault, up to about the middle of its vertical height, is of solid masonry. From this level to the first horizontal ring in which the tracery is worked, the construction is rib and panel work, the ribs formed of separate stones in three lengths rebated to receive the panels, which are dropped in; the whole panel consisting, in most cases, of four stones, with the joints at irregular intervals, as shewn in *Fig.* 3, which is a section, taken at *p*, in *Fig.* 2. Above the rib and panel work, the groin is worked in solid jointed masonry; the courses forming segments of rings with conical arch-joints. The vertical joints radiate from the centre of the vaulting-shaft; the first ring having the radiating joints in the centre of the arch-heads of the panels. The second ring is divided into smaller panels by a minor rib, and the radiating joints being in the centre of the head, these stones break joint with the first. The

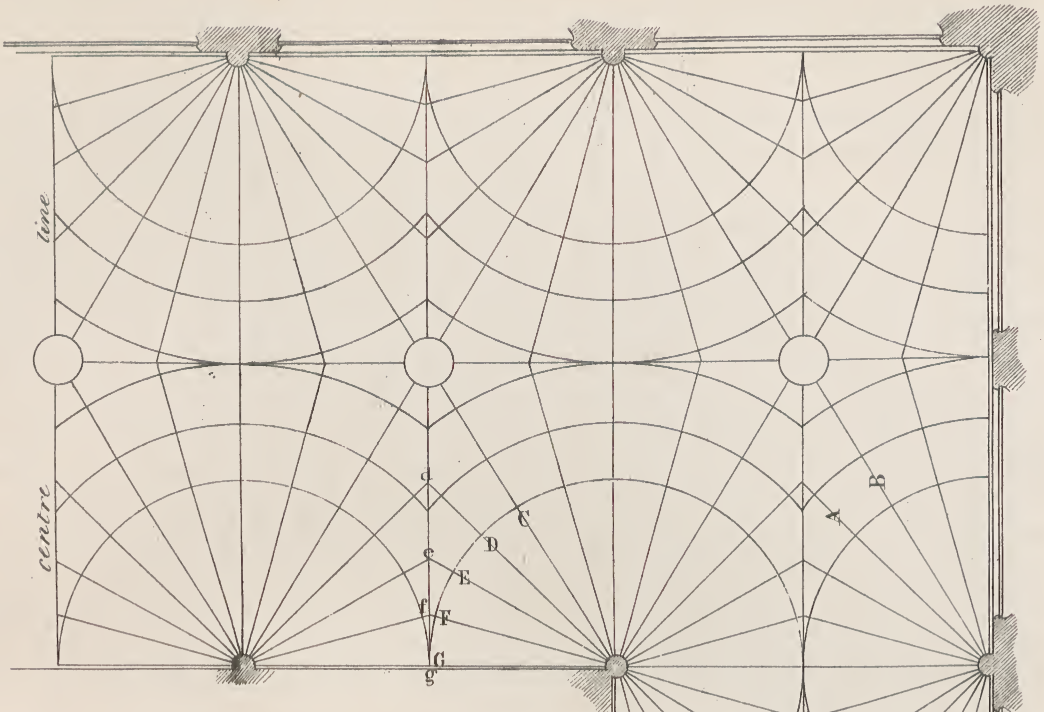
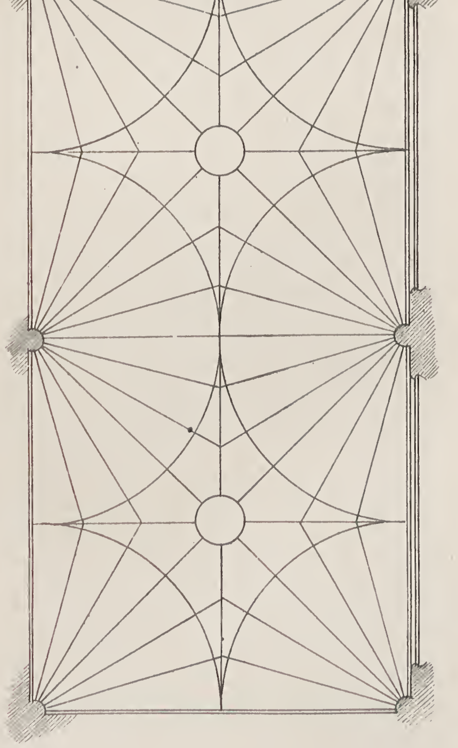

FIG. 1.

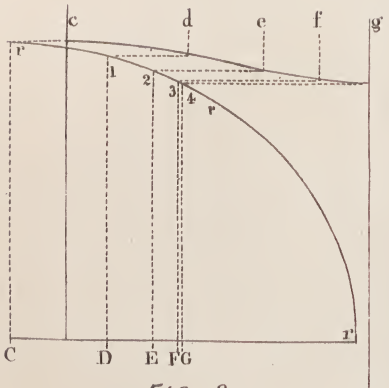

FIG. 2

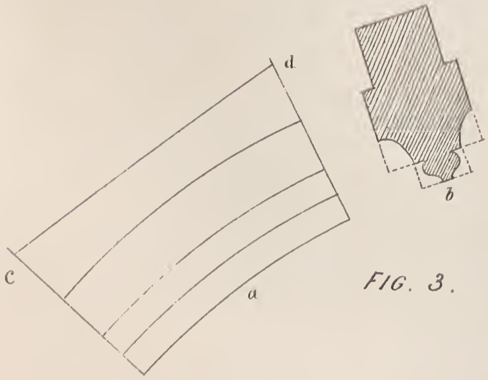

FIG. 3.

SCALE OF IN: 12 6 5 4 3 2 1 0 5 10 20 30 35 FEET.

D. Ruddle Archt.

London James Hagger 67 Paternoster Ro

gauged to its proper width; lastly, the lines bounding the parallel faces of the ribs are scribed on the latter with a gauge applied to the soffit, and the mouldings are sunk by means of a mould applied to these lines, and to the arris lines of the soffit."

Another method, differing slightly in the order of proceeding, is the following:—Let *a*, *Fig.* 3, *Plate* 6*f*, be the elevation, and *b*, the section of one of the stones of a rib to be worked, as set out from the full-sized elevation and plan of the vault: having which, the first operation is to make the required moulds, as previously described, under the head of "Arches," in Chapter V. Then work one face of the stone, apply the *face* mould, mark the form on the stone, and then work the two beds, *c*, and *d*. Apply the *bed* mould, which is a section of the rib (see *b*), upon these two surfaces, and mark the form on them; then work the other face of the stone parallel to the first one, and at a distance equal to the thickness of the rib, and after, work a draft to the curve of the arch along the soffit of the rib; for which a curved rule must be made. Surfaces of operation are now to be formed by sinking down to the face of fillets, or to any other suitable point of the mouldings, square from the soffit and vertical faces; using curved rules of the proper sweep, for the points at which they are to be applied. The form of the several mouldings being next worked with the aid of reverse moulds, to assist the mason in determining the section at different points in the length of the stone, the operation is completed.

With reference to the curved rules for obtaining the proper sweep of the various mouldings, it may be observed, that instead of using such, the following mode is sometimes adopted. Having marked the form of the section on the beds of the stone at *c* and *d*, and worked the second face parallel to the first, at the distance equal to the thickness of the rib, as before mentioned; then work the soffit square through from these faces, and by means of gauges, draw on the soffit and the faces, the lines of the surfaces of operation proposed, and the edges of the intended mouldings; the former of which may then be produced by sinking square from the surfaces, and the latter in the same manner as in the previously directed plan of operation. The first method, however, is the better of the two, from its being susceptible of greater accuracy; while the expense of the curved rules or moulds for the sweeps, made in thin zinc, or wood, is very trifling, and in the case of large ribs, is fully compensated for in the necessity for working a draft only along the soffit, instead of having to square the latter through the whole thickness of the stone.

On the boss and keystones at the intersection of the ribs, Mr. Dobson, before referred to, remarks that "each rib being a separate arch, its middle section must be a vertical plane, and the mouldings of the ribs will, therefore, not mitre, but intersect each other in a very awkward manner." To conceal which, he continues, "the keystones are worked with a round lump or boss, ornamented with foliage and sculpture; so that the mouldings die into the ornament without intersecting each other;" and he gives an illustration, showing a mode of working the boss-stone at a less expenditure of material than was consequent upon the method employed by the Gothic masons, whose plan for obtaining "the form of the boss-stones, and the position of the stumps of the ribs, was," he adds, "to take a large block, and to work upon it an upper horizontal surface of operation, to which the centre lines of the ribs were

transferred from a full-sized plan of the vault; and the form of the soffit was then obtained by squaring down from this upper surface." In modern practice, a very usual mode of forming the boss stones, founded on and derived, probably, from this older method, is as under:—First work the upper surface of the stone, so that, when fixed, it may be horizontal; and upon this surface of operation draw the centre lines of the ribs, exactly as laid down in the plan. This being done, work the junctions, or joints, with the ridge-ribs, square down: the ridge will be kept in position by the stones forming the spandrils of the vault, but, if desirable, the ends of the ridge may be notched a little on the boss stones, which will then, likewise, support it. Work also the joints with the other ribs to the correct bevel, or radiation; then mark upon the beds and joints thus formed to receive the ribs the proper sections of the same, as a guide to their correct position, and proceed to fix, working the stumps on the boss after the centreing has been removed. The boss stone at the intersections of a diagonal or intermediate, and a lierne-rib, are to be worked in the same manner, using the upper plane as a surface of operation; but as the stone forms, in reality, one of the voussoirs of the intermediate or diagonal rib, as the case may be, it is supported by its connexion with the other stones of the rib, and the beds, or joints, in this direction, radiate towards the centre from which the arch of the rib is described. The beds of the lierne-ribs upon the boss stone, in old examples, frequently form an acute angle with the soffit line of the rib or ridge, so that the stone of either is longer on the top than on the soffit, without reference or attention to the bed being square from the soffit, and the stone is thus kept from falling through; but the better mode is to work the beds in the proper direction, and notch the upper half of the rib about an inch on to the adjoining stone. In either case, the surface of operation being formed, the centre lines of the ribs are to be drawn upon it, as before described, and the beds worked down by means of templets or a bevel, the remainder of the operation being the same as in the central, or key, boss.

In the case of the springing-stones, it is customary to work these in horizontal courses to the point at which the several ribs intersect each other, from below which the ribs cease to be worked as separate arches. In good work, however, as before observed, the springing-stones should be formed to radiate, particularly if of any height, or arranged to receive the ribs at different levels, as is frequently seen in foreign groins, and elsewhere where the ribs die into the abutments from whence they spring without the intervention of capital or impost. In working them in either case "the upper and lower beds of the stones," says Mr. Dobson, whose valuable observations are again quoted, "are first worked, and the centre lines of the ribs marked upon them. The position of the soffit of each rib is then transferred to these lines from a full-sized elevation, and the soffits worked with convex templets applied to the top and bottom arrises. Lastly, the soffits are gauged to the proper widths, and the mouldings worked out with moulds applied in a direction radiating from the curve of each rib." In the filling in, or panels, the vertical joints of the stones, as before remarked when describing *Fig. 3, Plate 6a*, are cut to radiate to the centre of the vaulting shaft; the horizontal joints, or beds, in the case of solid construction more particularly, being level.

In conclusion, it is to be observed, that in what has been previously said, remark has been

confined, as will be noticed, to the English examples of the several periods spoken of, as offering more ready means of reference, and being more generally accessible objects for examination. There are abroad, however, particularly in Germany and France, numerous valuable exemplars of mediæval groining, worthy the most careful and attentive study. As in our own country, they are affected by period, and by local as well as other circumstances, and are consequently more or less in the same manner to be considered, when consulted for the purposes of exposition and practical use. The main divisions in the character of foreign groining, nevertheless, approach very nearly to those which distinguish corresponding periods here, qualified by, and taking into consideration the fact, that continental architecture generally, and with it, of course, such portions as are more particularly the subject of notice here, is in advance of that of this country, exhibiting an earlier development than with us of the peculiar phase of each period. Thus, the perfected earlier pointed forms of the continent, such as would here be denominated Early English, would range with our later transitional, and their later decorated* with our middle and advanced perpendicular. Amiens, for instance, which has been compared with Salisbury† has much in its detail of a character more resembling the later work of Lincoln; and similar observation may be made with respect to other instances. Further, it is noticeable that greater simplicity generally characterises the earlier foreign groining, as it does much of the sculpture in early French capitals. As regards the latter, those at Amiens are of a much more simple character than those at Salisbury; while, says Dallaway,‡ "the rich vaultings of our later Gothic far excel anything of a similar description on the continent."

Without entering, however, into minute or extended review of the foreign examples of groining, which would necessarily extend remark far beyond the limit requisite to be observed in a notice such as the present, it may serve equivalent purpose to direct the attention of the reader desirous of considering further the subject, to the following enumerated works, in which several of the most considerable of those of France and Germany are carefully and profusely illustrated, in connexion with the edifices of which they form a part, and by reference to which, examination and comparison may be fully and advantageously pursued.

Boisserée.—" Histoire et Description de la Cathédrale de Cologne, avec de Recherches sur Architecture des Anciennes Cathédrales." Imp. fol., Paris, 1827.

J. Sell Cotman.—" Architectural Antiquities of Normandy, with historical and descriptive notices." By Dawson Turner, F.A.S. Imp. fol., London, 1822.

Ducarel.—" Anglo-Norman Antiquities;" folio, 1767. Translated, with copious notes, by M. Lechaude, Caen, 1823.

Gilbert.—" Description, &c., de Nôtre Dame de Rouen;" " Description, &c., de l'Eglise de St. Ouen." 8vo, 1816.

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* The golden age of French Decorated, says Dallaway, (Obs. p. 83), was from the middle of the 13th, to the latter end of the 14th century.

† See an accurate description of their relative parts, says Dallaway, (Obs. p. 81), in Whittington's *Historical Survey of Ecclesiastical Edifices in France*, 8vo, 2nd ed. 1811.

‡ *Observations on Gothic Architecture*, p. 80. 8vo, London, 1830.

Jolimont. — "Description Historique et Critique et Vües de Monumens Religieux et Civiles les plus remarquables de Département du Calvados." (Caen), fol., 1825.

Jolimont.—" Cathedrales Françaises;" folio, 1826-1830. Lithographes, en livraisons.

Moller (G.).—" Essay on the Origin and Progress of Gothic Architecture." Translated from the German, 8vo., 1824. The original work published at Darmstadt, 1819-1822. Imp. fol., fourteen numbers.

Moller.—" Monumens de l'Architecture Allemand." 15 livraisons, folio. Darmstadt, 1819-1824.

Pugin and Le Keux.—" Architectural Antiquities of Normandy;" 4to, 1827.

Whittington.—" Historical Survey of Ecclesiastical Edifices in France;" 8vo. Second edition, 1811.

Wheley (Professor).—" Essay on German Churches, with remarks on the Origin of Gothic Architecture;" 8vo. Cambridge, 1830.

Whewell (Dr).—" Architectural Notes on German Churches."

CHAPTER VIII.

ON CRAMPING, DOWELLING, &c.

The use of cramping, dowelling, and such-like constructive aids in masonry, is of very ancient introduction. In the architecture of both Greece and Rome, such modes of connecting the large stones used in the buildings of these countries were common, and the practice has been continued more or less to the present day.

The ancients appear to have used indifferently, iron, copper, bronze, and hard woods, and in some cases the dowells were of exceeding large size. Those used in the great Temple at Balbec seem to have been of iron, and from the measurements taken of the cavities formed for their reception in the blocks composing the shafts of the columns, must have been no less than a foot in length, by nearly the same dimension in circumference.*

In the Coliseum, as was discovered on the displacement of some of the stones of the wall by an earthquake, which occurred at Rome at the commencement of the 17th century, the cramps were of copper, set in lead. Bronze was of very common occurrence, and we have notice of a frequent and early use of wood for the same purpose. St. Jerome, in his commentaries on Habakkuk, chap. 2, v. 11, speaks of cramps of wood, as being in his time inserted in the

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* Vide, *Ruines de Balbec.*

FIG 3.

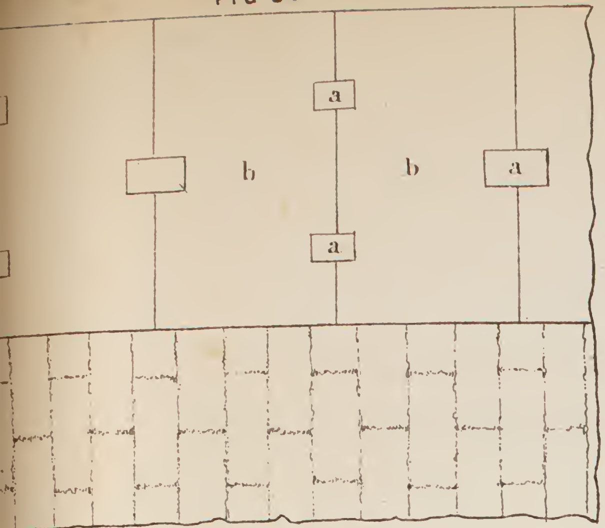


FIG 1

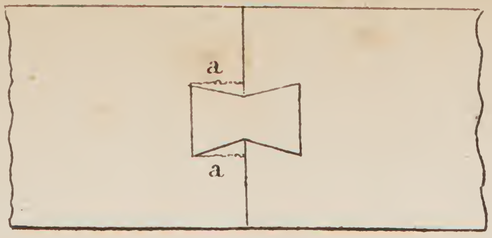
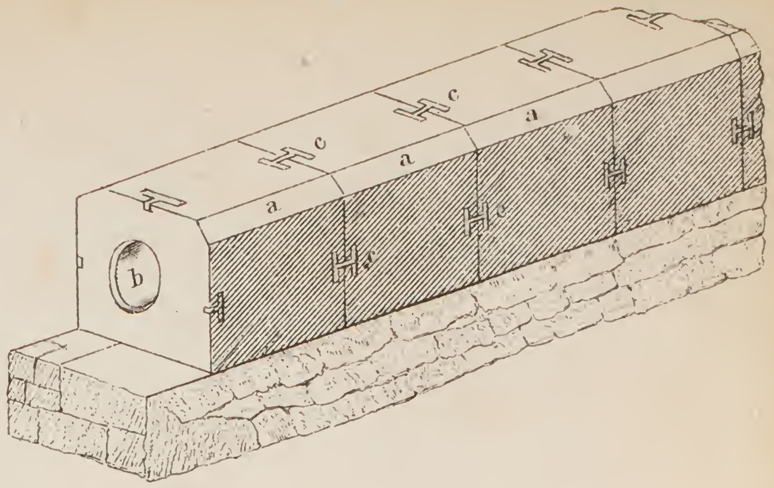


FIG 4



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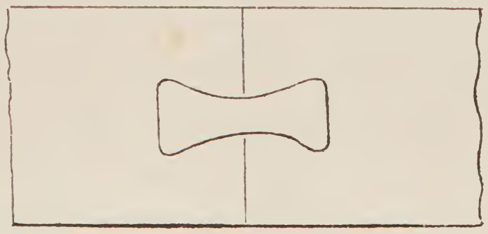


FIG 8

FIG 7

FIG 7a

FIG 23
Section.

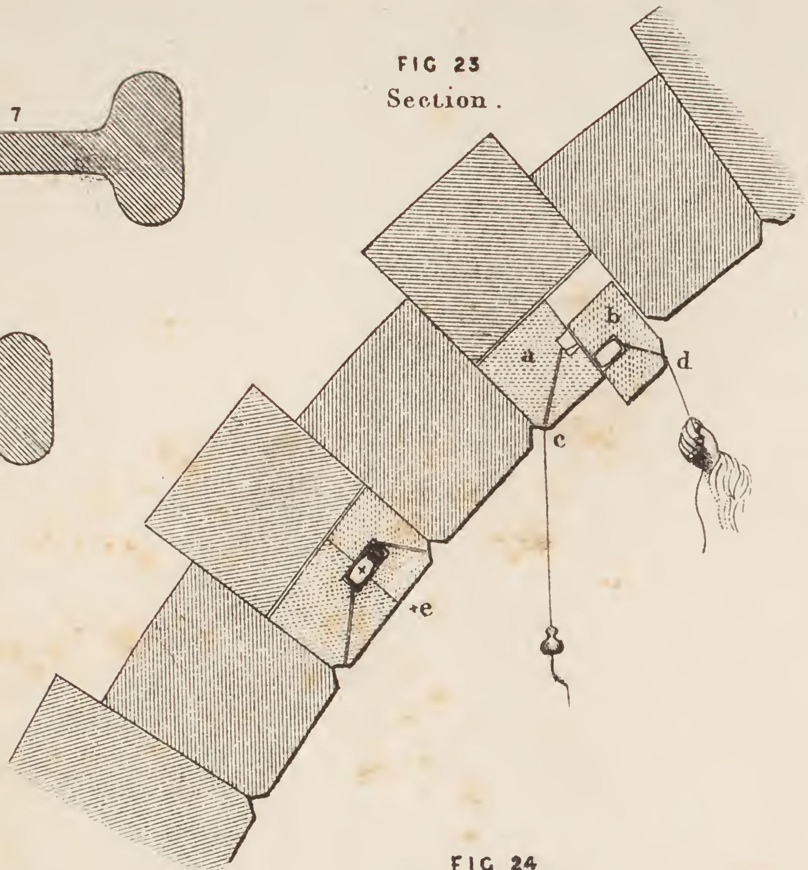


FIG 6

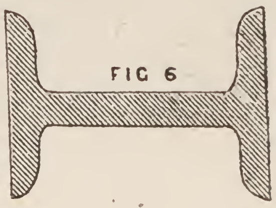


FIG 5

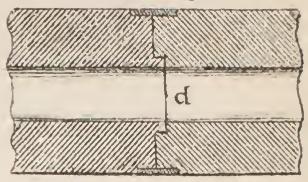


FIG 13

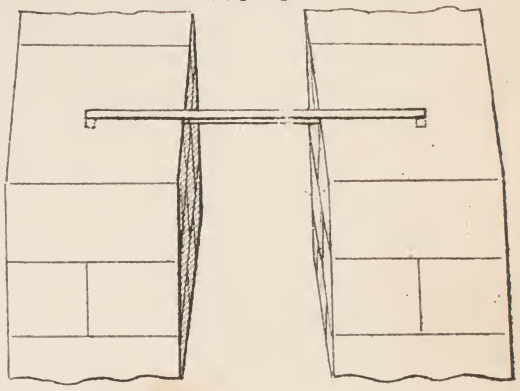


FIG 14

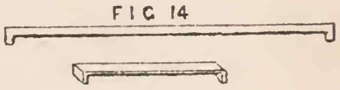


FIG 9

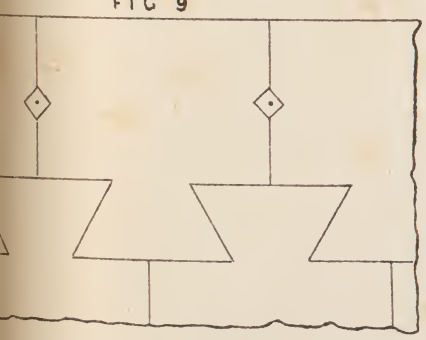


FIG 24
Plan of Soffit.

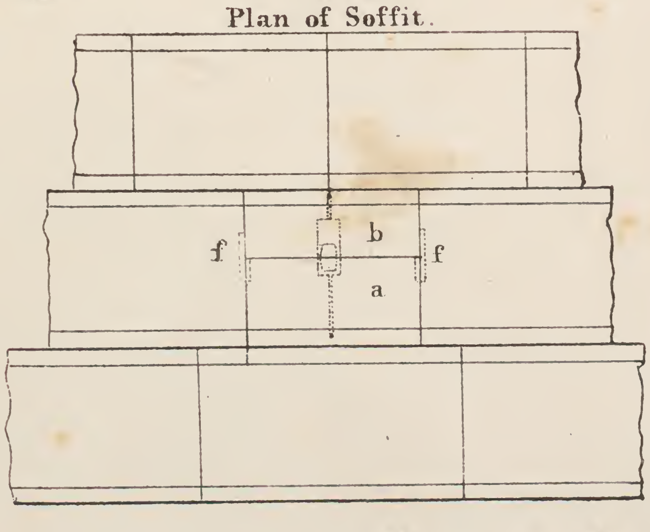


FIG 15

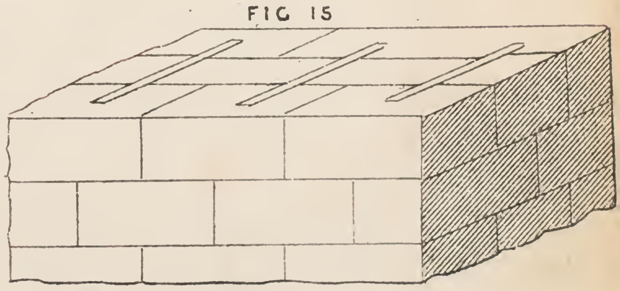


FIG 10

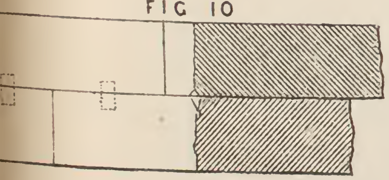


FIG 16

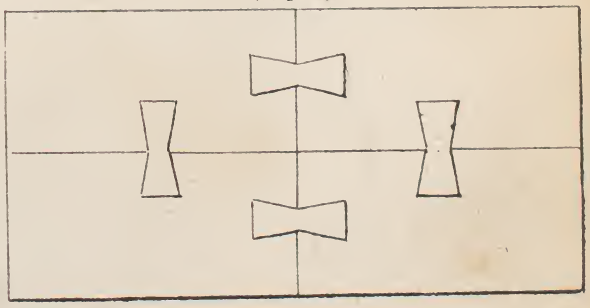


FIG 11

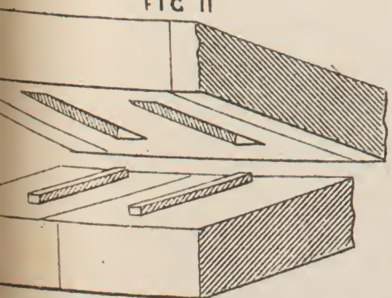


FIG 20

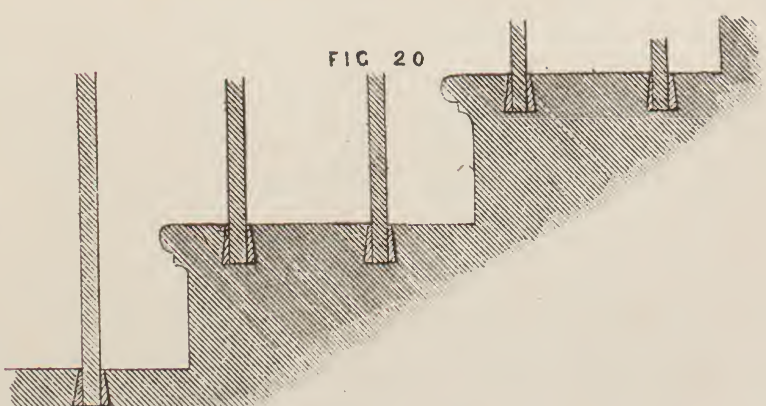


FIG 17

FIG 18

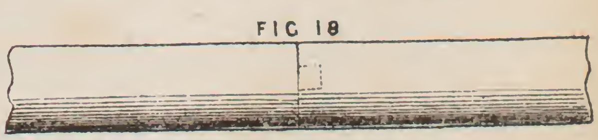


FIG 12

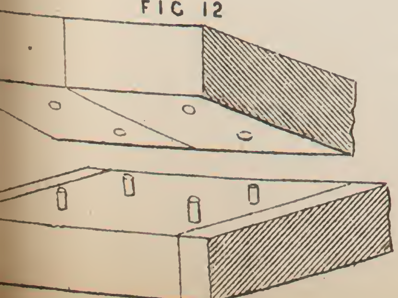


FIG 21

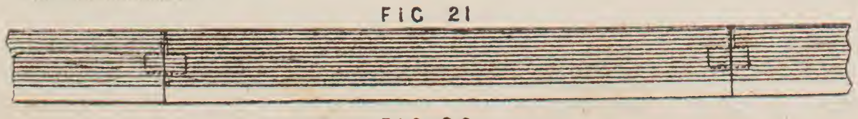


FIG 22

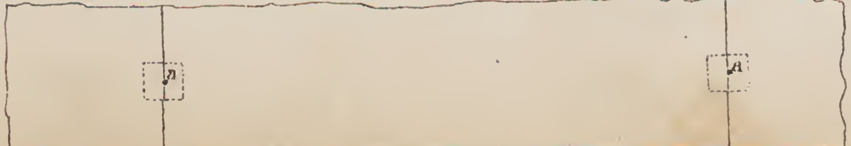
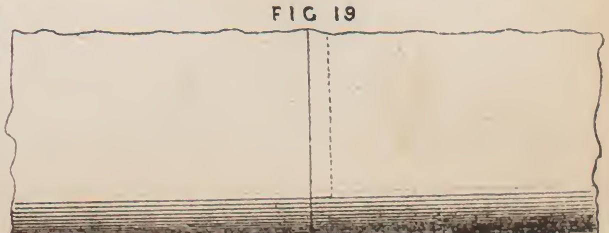


FIG 19



midst of walls, to render them more solid; and M. le Roi, in his work, "Ruines de la Grèce," says, that the courses of a very ancient column discovered by him, at the foot of the mountain of Laurium, were secured by keys, or dowels, of a hard red wood, then still in good preservation, the holes for which, formed in each course, were three inches in breadth, and four inches deep. In a Greek Aqueduct, discovered near Patara, on the coast of Lycia, a representation of a portion of which is given in *Plate* 7, *Fig.* 4, the cramps were of iron, of an H form, run with lead.

Ties, or long continuous lengths of metal, were also often introduced in the construction of ancient entablatures, for additional security where the intercolumniations were wide. They have been found attached to metal dowels and vertical bars, inserted between the capital and architrave, extending along and let into the soffit of the latter, as well as also between the architrave and frieze; the dowels in this case being sometimes rods of sufficient length to penetrate the capital, architrave, and frieze, and some way into the cornice.*

In the architecture of the middle age, iron ties of a like description are frequently observable.† In the Early English work of Westminster, Salisbury, and other instances, such are introduced at the springing lines of the arches, as connecting and steadying links; and in the spires of Strasburg, and St. Stephen, at Vienna, (see *Plate* 7^{c}, *Figs.* 5, 6, 7, 8, and 9,) there is a considerable use of iron tying and cramping, both in the main construction and for the purpose of attaching the more ornamental portions of the design thereto. In the later perpendicular churches of this country, particularly in connexion with the numerous and closely arrayed lights of this style, there is also a free use of iron ties, which in several cases extend in connected lengths through the windows and piers, and, in the majority of instances, very far into the latter—not, however, as will be hereafter noticed, always with the most beneficial result—since the expansion of the metal, unprovided for, has generally fractured the stones with which the iron has come into connexion.

It is in works of a later age, however, and in countries where the construction was of necessity composed and regulated by materials less bulky than were employed by the ancients, and requiring a different constructive treatment and consideration, that similar practices are more fully exhibited. In the ancient instances the cramps and such-like introductions are, strictly viewed, merely and more simply aids, and not so much really constructive accessories, as they appear in many of the more modern erections.

In the later revivals of classic architecture, where the horizontal construction had to be retained and formed of a number of separate stones—the ancient usual method of single blocks between column and column being unattainable—this latter character in the cramping and connecting admissions of a similar kind, is particularly observable. A remarkable instance of this is shewn in the case of the colonnades of the Place Louis XV., and the Louvre, at Paris, the former by Gabriel, architect to the King, and the latter by Perrault, the architrave and frieze of which are formed by a series, as respects principle, of straight arches of

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* See *Mèmoires sur les objets les plus importans de l'Architecture*, par M. Patte, 4to, Paris, 1769.

† They are found described by the French masons as "Tenans en fer." See Dall. *Obs.* p. 121.

stone, tied together and deriving a large amount of assistance from the iron cramps and ties, which are inserted between and in the substance of the several stones of which they are composed; the soffits, or ceiling beneath to the colonnades being similarly treated. As examples of a very full introduction of metal assistants of this description into masonry, these are, perhaps, among the most interesting that can be referred to, as will be seen on reference to *Plates* 7*a* and 7*b*, which exhibit a plan and sections of one compartment of the colonnade of each, derived from the work of M. Patte, before mentioned. In the first of these Plates, viz. *Plate* 7*a*, which, with its fellow *Plate*, 7*b*, it will be best here, and before proceeding to the explanation of *Plate* 7—which exhibits still more modern methods of the practice—to describe, *Fig.* 1 represents the half plan of one bay or intercolumniation of the colonnade of the Place Louis XV., taken above the soffit between the frieze and cornice, in which—

A, shows an iron dowel, or bar, seen also sectionally in *Fig.* 3, inserted in the axis of the column, piercing the architrave and frieze, and the first course of stones joining the cornice; being about two and a half square in substance.

A*, Corresponding vertical dowel, or bar, let into the back wall of the colonnade.

C*, Stirrup irons, sustaining the ties B and M, *Fig.* 2.

E, Vertical bar, or dowel, seen in elevation in *Fig.* 3.

H, Smaller ties, united to the ties, P, P, and serving to support the centre stone of the soffit, by means of the four stirrup irons, O,O.

M*, Tie following that marked M, in the course above.

N, Tie acting as a lintol.

Q, Another small tie, connecting the ties P, before mentioned.

Fig. 2 shows, in like manner, the half plan of the intercolumniation, or colonnade, taken through the substance of the entablature, at the level between the frieze and architrave, previous to the soffit being constructed; and it is to be noticed here that the letters in this, as in the former plan, as well as in the sections, are corresponding, and have reference to the same points, or objects, in each.

A, Vertical dowel, in the axis of the column (as in *Fig.* 1) passing to this height through the eyes of the three ties, shown sectionally at B, in *Fig.* 3.

A*, Corresponding vertical bar in the back wall of the colonnade, seen sectionally also in *Fig.* 3.

B,B, Horizontal ties connecting the columns.

M,M, Ties at right angles to the preceding, fixed at one end to the vertical bar A., and at the other to the similar bar, B.

C,C, Stirrup-irons, sustaining the lintol K, *Fig.* 3.

D,D, Heads of the *I*-formed irons, which support the key-stone.

E, Button, or ferrule, of a small vertical bar, seen sectionally in *Fig.* 4.

T, Great, or principal, tie with connecting flanges, placed in the thickness of the back wall of the colonnade.

Fig. 3 is a section of the colonnade, taken on the line of its breadth, or projection, through the centre of a column and pilaster.

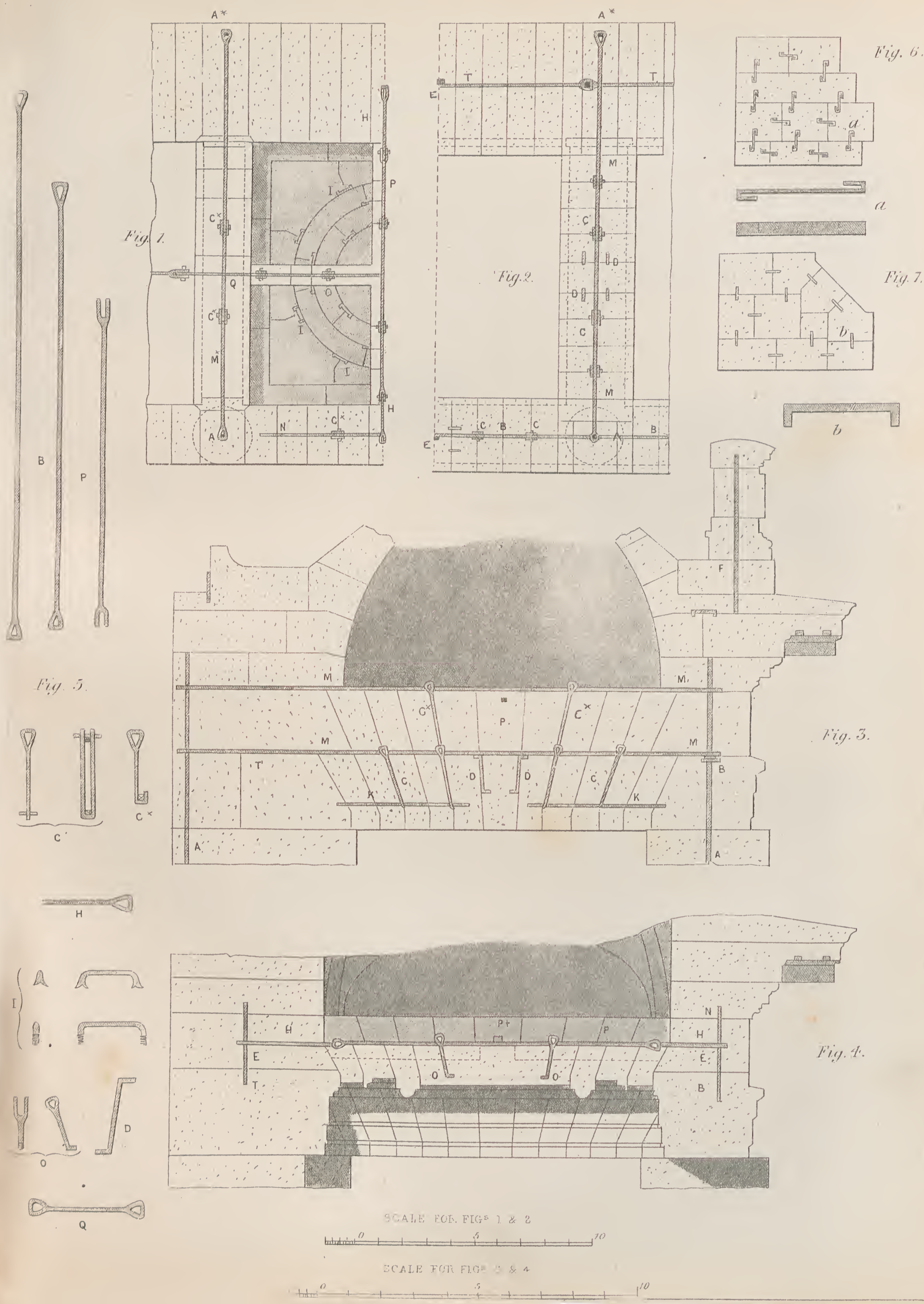
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
SCALE FOR FIGS 1 & 2
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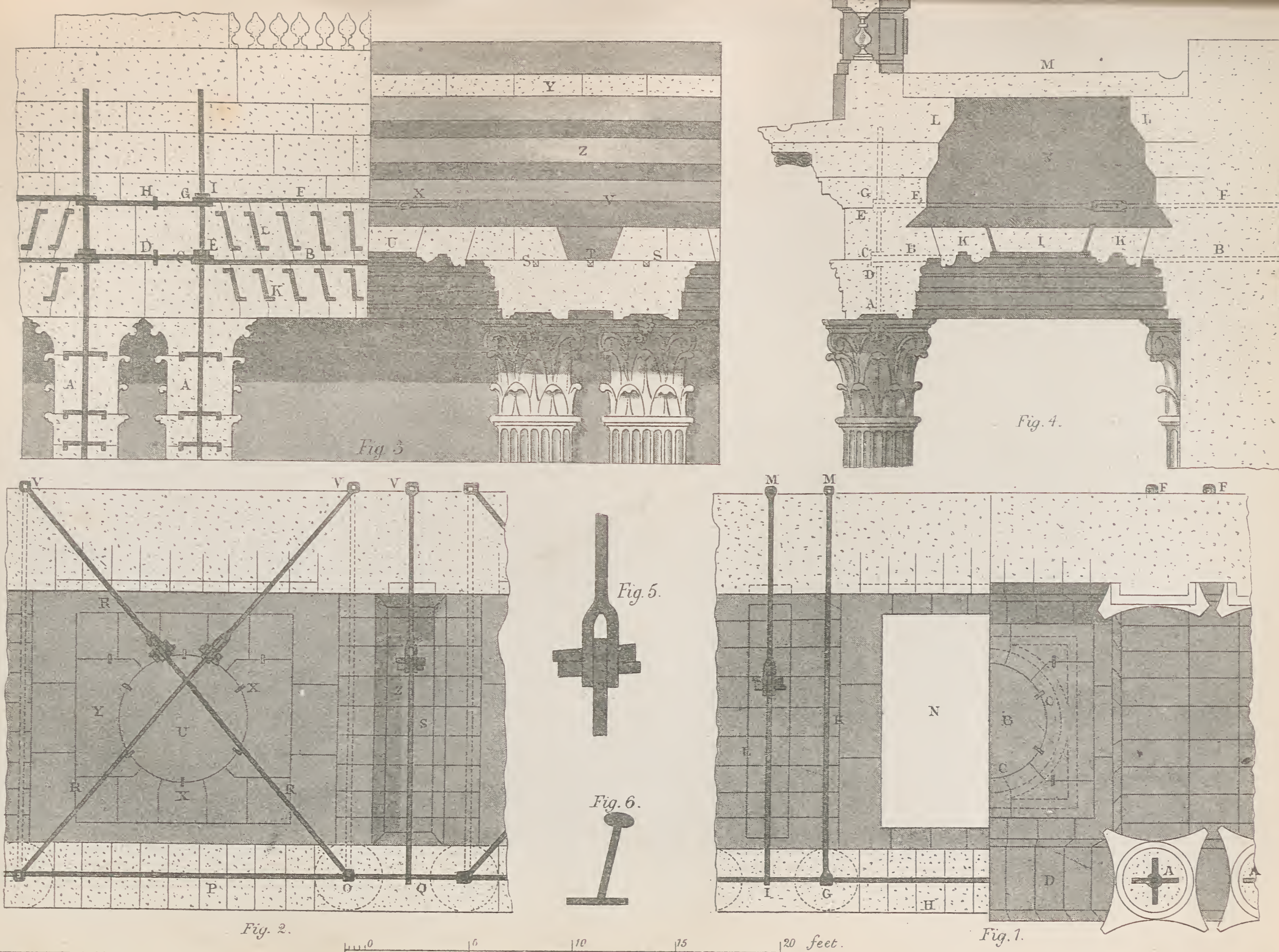

Fig. 3. Fig. 4. Fig. 2. Fig. 5. Fig. 6. Fig. 1.

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A, and A, Vertical dowels, as before, at front and back.

B, Section of the horizontal tie.

C, C, and C*, Stirrup-irons.

D, D, *I*-shaped irons carrying the key-stone, as before.

F, Vertical bar, or dowel, inserted in the middle of the pedestal of the balustrade.

K, K, Lintols.

M, M, Cross ties.

P, Section of an intermediate tie.

Fig. 4. is a similar section taken across the breadth, or projection of the peristyle, but through the centre of an intercolumniation, or between column and column.

B, Section of a horizontal tie.

E, Vertical bars, or dowels, to hold the ties H and P.

N, Section of the lintol.

P*, Section through a tie which crosses the tie P, which supports the centre stone of the soffit, and from which are suspended the stirrup-irons O.O.

I, Other ties, seen in section.

Fig. 5, shews in detail the different irons, the letters on each corresponding with those on the preceding figures.

M, Tie between the frieze and the architrave. There is also a similar tie between the frieze and cornice.

B, Horizontal tie, 2 inches thick, connecting the axes of the columns lengthwise of the colonnade.

P, One of the cross ties aiding to support the ceiling of the soffit.

Q, Another similar tie for the same purpose.

C, Stirrup-iron, double branched, seen in front and in profile.

C*, Stirrup-iron, single branched.

H, Small tie passed over the axis E, to carry the ceiling.

I, Form of the cramps inserted between the voussoirs or stones of the ceiling.

O, Stirrup iron, seen in front and in profile, sustaining the key-stone of the ceiling.

D, Cramp made in the shape of a Z, to support the key-stone of each soffit of the intercollumniation.

Figs. 6 and 7, shew the mode of cramping used in the foundations of the Church of St. Geneviêve, at Paris, *a* and *b* being the enlarged form of the cramps.

In the second Plate, that is to say *Plate 7b*, which shows the construction of the entablature and soffits of the peristyle of the Louvre, the second of the examples mentioned, *Fig.* 1 shows, on the one side, the half plan of the soffit of one intercolumniation, or compartment, of the peristyle viewed from below, and on the other, the half plan taken at a higher level, between the frieze and cornice, as seen before the filling in, or completion, of the soffit.

A A, represents, in the first-mentioned half, two of the coupled columns of the colonnade, their axes traversed by an iron bar, about 3 inches in substance, embraced at each course of the

stones of the shaft by a cross-formed cramp of plate iron, two of the arms of which are let into the upper, or superior, course, and the other two in the lower, or inferior, course.

B, indicates the under side of the centre stone of the soffit, which is in one piece.

C, Position of reversed T-irons, which support, or carry, the centre stone.

D, Underside, or soffit, of the architrave.

F, F, Eyes of different ties, on the second half plan, or that to the right.

G, shows the column with its iron central dowel, A on the other half plan.

H, Grand, or main, horizontal tie, uniting the iron axes of the columns of the intercolumniation.

I, Smaller horizontal ties, uniting, in like manner, the axes of the coupled columns.

K, Tie at right angles to the last, fixed at one end to the vertical iron G, and at another to an anchor, or boss, let into the wall of the peristyle.

L, Other ties attached at one end to the middle of the horizontal tie I, and at the other to an anchor.

M, M, Anchors or bosses.

N, Void position of the lacunaria, or soffit, shown filled in in the other half plan and perfected in *Figs*. 2, 3, and 4.

Fig. 2, in the same Plate, gives a plan taken between the frieze and cornice, shewing

O, Iron vertical dowel of the columns A and G, on half plan *Fig*. 1:

P, Horizontal tie, connecting the vertical dowels at the upper part.

Q, Another horizontal tie, similar to the tie I (*Fig* 1.), uniting the coupled columns.

R, R, Diagonal ties, fixed at one end to the iron dowel O, and at the other to the same anchor, or boss, which serves to receive also the tie K (*Fig*. 1).

It is to be observed that these ties, R, have in the middle of each a fork, or flange, with pins, or wedges, to bind and tighten them more or less, as may be required; shown at large in *Fig*. 5.

S, Tie at right angles to the tie Q, embracing the latter in the middle at one end, and fixed at the other in an anchor, V, which also holds the tie L (*Fig*. 1).

T, represents, by dotted lines, the situation of the tie already distinguished as K, in *Fig*. 1.

U, Centre stone of the soffit, viewed from below: figured as B, in *Fig*. 1.

V,V, Anchors.

X, Heads of reversed T irons.

Y, Stones of the soffit.

Z, Void formed above the soffits of the coupled columns.

Fig. 3, is a section taken along the length of the peristyle, the one-half within the substance of the entablature across the axis of the columns, the other half through the centre of the soffit, in which,—

A,A, shews the iron dowel, or bar, passing vertically through the centre of the columns, embraced at each course by the cross-formed cramps shewn and described in *Fig*. 1.

B, Longitudinal tie, uniting the iron vertical dowel at the height of the architrave-

C, A similar tie, uniting in the same manner the coupled columns.

D, End of the tie at right angles to the above, being L, on *Fig.* 1.

E, End of another transverse tie, through the eye of which the vertical dowel of the shaft passes.

F, Longitudinal tie, placed above the frieze, to connect at that height the vertical dowels.

G, Another similar tie to C, at this height.

H, Eye of a tie at the right angles to the last.

I, Eye of the diagonal tie R, in *Fig.* 2.

K, L, Large Z-shaped irons, inserted between the joints of the stones of frieze and architrave.

S, S, and T, Transverse ties at the height of the architrave.

U, Key-stone of the soffit, seen in section, with the rest of the stones forming the latter.

V, Transverse ties at the height of the frieze.

X, The diagonal ties.

Y, Flag-stones forming the floor of the terrace which covers the peristyle.

Z, Void above the soffit.

Fig. 4, concluding the illustration, is a transverse section through the breadth, or projection, of the peristyle, in which,—

A, Is a section through the architrave, shewing in dotted lines the vertical bar or dowel, rising to the height of the cornice.

B, B, Transverse tie on the upper surface of the architrave.

C, Longitudinal tie, H and P, *Figs.* 1 and 2.

D, End of the small tie connecting the coupled columns.

E, Longitudinal tie at the upper surface of the frieze.

F, F, Tie transverse to the preceding.

G, End of the horizontal tie connecting the columns of the intercolumniation.

H, Anchor receiving the two transverse ties, B and F.

I, Centre or key-stone, &c., seen in section.

K, Reversed T-irons, carrying the key-stone; shewn at large, *Fig.* 6.

L, Courses of stone, corbelled out for increased depth of bed and bearing to the projecting stones of the cornice.

M, Floor of the terrace.

N, Void between the soffit and the terrace.

Figs. 5 and 6, shew at large the connecting forks and wedges of the ties R, S, and L, in *Figs.* 1 and 2, and the reversed T-irons C and X, *Figs.* 1 and 2, which sustain the key-stone of the soffit.

As before observed, the admission of the iron aids in these instances are very full and constructively employed. In still more modern works they appear to less extent and more adjunctive, occasioned by a freer use of brick in connexion with stonework, and the consequent more superficial applications, generally, of the latter where now employed.

With reference to the modern practice of cramping, dowelling, joggling, and tying, &c.,

it will be found that the terms are frequently used indifferently to denote the same processes. They are also distinguished by different and peculiar local names, in different parts of the country. A cramp may, however, be properly distinguished, perhaps, as a vertical or horizontal bar of iron or other metal, caulked or bent at either end, inserted in the beds or courses of stones, to connect or tie the same together, or in various other forms to attach ashlar facings to the main work of walls, &c. Dowelling, properly, may be taken as the application of vertical or horizontal plugs of wood, stone, or metal, to connect and prevent a longitudinal or other slip, or separation of the material, as in the case of the stone courses of a column, the boarding of a floor, &c. Joggling is the uniting of two pieces of stone by means of a projection formed in the vertical section of the edge of one, called the male joggle, and a corresponding recess or groove in that of the other, called the female joggle; as in the case of landings of stairs, balconies, or other surfaces, formed of slab-stone. Tying, it is perhaps hardly necessary to add, is an introduction of iron, or other metal, in lengths, to act against outward thrust, and to connect opposite and distant points, or to preserve connexion under settlement. Iron chain-bond, frequently used in foundations, &c., and the chains in the dome of St. Paul's, are ties of the former, and the hoop-iron, and other such-like contrivances, of the latter description. Thus distinguished, and without entering into a description of each particular and varying term employed, it will be here sufficient, in proceeding, to consider them.

As a general rule, with reference to the material to be employed, care should be taken that such is suited to the special requirements of the locality in which it is to be used. Lead, in connexion with iron, should never be admitted where there is exposure to the air, or at all, if it can possibly be avoided. It is better to expend time, patience, and extra expense in good fitting, and to bed the metal in first-class cement. If, however, it is unavoidable, as in harbours, lighthouses, and other such heavy works, cast iron should be adopted in preference to wrought, and the metal should be heated slightly, and coated with oil, previous to being inserted, and the lead then run in. It may be questioned, nevertheless, whether the harder kinds of wood and stone might not be used with advantage in all cases, due care being taken, however, with respect to the former, that it is thoroughly seasoned, and placed in a situation where moisture or wet cannot reach it. It should also be accepted as an axiom, that thoroughly good fitting is essential in every of the above methods, to render the work sound and permanent.

In the Plates, a description of which will now follow, several of the more usual as well as various other modes of cramping and dowelling, &c., are exhibited in illustration of the subject, which, in many instances, in connexion with building in stone, it is needless to say, is one of considerable importance.

Fig. 1, *Plate* 7, is the dowel or dovetailed joggle most commonly used, and made either of iron, bronze, or bell-metal, hard stone, such as granite, whin-stone, &c., and occasionally, of wood. As before observed, if of iron, the dowel should be slightly heated, and thinly coated with oil, before being run in. With bronze or bell-metal, lead or good Portland cement is ordinarily employed, as the latter is usually with wood and stone.

It may be remarked that, although this kind of dowel undoubtedly possesses many recommendations, yet from its shape it has a tendency to break the stone, as at *a*, *a*; a danger less imminent in the case of the dowel shewn in *Fig.* 2, the less objectionable form of which, however, entails extra amount of labour.

Fig. 3, is illustrative of the use of hard whinstone dowels, *a*, *a*, *a*, to secure or connect the free-stone blocks, *b*, *b*. This method is largely adopted, and was employed, it is believed, in the building of the Newhaven pier.

Fig. 4, is an example of cramping, taken from the Greek aqueduct discovered at Patera, opposite the Isle of Rhodes, before referred to, at page 69. The cramps, *c*, *c*, *c*, run in with lead, are here used to connect together the stones of what is, in fact, a stone pipe, formed of a series of blocks *a*, *a*, *a*, closely jointed, laid in cement, and pierced with a circular channel, shewn at *b*., *Fig.* 5 being a vertical section through the same, shewing the upper and under cramps, and the spigot and faucet joint *d*.

Figs. 6, 7, and 7a, are sections of ordinary ribbed iron. *Fig.* 6, the H-sectioned, is used principally for rafters, in iron roofs, &c. *Fig.* 7, the rail-sectional bar, is used for standards, and also in iron ship building, &c. It can be had from 8 to 9 inches deep. *Fig.* 7^a, is the ordinary permanent way rail, which is generally 4½ or 5 inches deep, and the same are here introduced for the purpose of calling attention to the point that, by merely cross cutting them into short lengths, they would, without further labour, make excellent cramps. The cutting could be readily and cheaply done to order at the iron-works, in the same way that covering plates, joint plates, &c., for girders, are at present done, and when a large quantity is required, at considerable advantage.

Fig. 8, is a section of part of the sea-wall of the Edinburgh, Leith, and Granton Railway, shewing the dowelling and the T-shaped cramping of the coping stones and parapet.

Fig. 9, shews a method of joggled and dovetailed jointing, sometimes used together in sea-walls, or in lighthouse-work.

Figs. 10 and 11, shew what is called a bed-dowel joggle, which, in the case of exterior work, is not run through to the outer face, but stopped off within an inch or two of it, so as not to be apparent.

Fig. 12, shews the connexion of the stones in a wall, and a means of preventing slip, by oak dowels or trenails, sunk half their length into the upper and under bed of either stone respectively.

Fig. 13, shews the use of iron cramping to bind together two separated blocks of masonry.

Fig. 14, are two forms of cramps of this description.

Fig. 15, represents similar cramp irons, fixed, or caulked, to the two outer stones in the thickness of a wall, crossing the joints and securing the interior ones.

Fig. 16, shews an application of dowelling to the bed-stones of stationary engines, and mill-work generally. If of oak, the dowels should be of well-seasoned material, boiled in oil, accurately fitted to the dowel-holes, and driven well home.

Fig. 17, simply shews the dowel in an enlarged form.

Figs. 18 and 19, illustrate the ordinary joggle-joint, used in the jointing of staircase-landings and balcony bottoms, &c.; and they are introduced rather as connected with the mode of so jointing stone, before referred to in describing the term "joggling," than as properly coming within the meaning, or applying to cramping and dowelling, here more particularly treated upon.

Fig. 20, exhibits the iron standards or ballasters of a staircase, run in with lead to the stone treads.

Figs. 21 and 22, shew a relative application of plugging, or crampings, run with lead, to stone copings, cornices, and other like projections. Care should be taken in all cases of fixing with lead, that the holes for the plugs or cramps, and the smaller holes (*a, a, a,* on the figure) through which the lead is admitted, should be perfectly dry before the latter is run in.

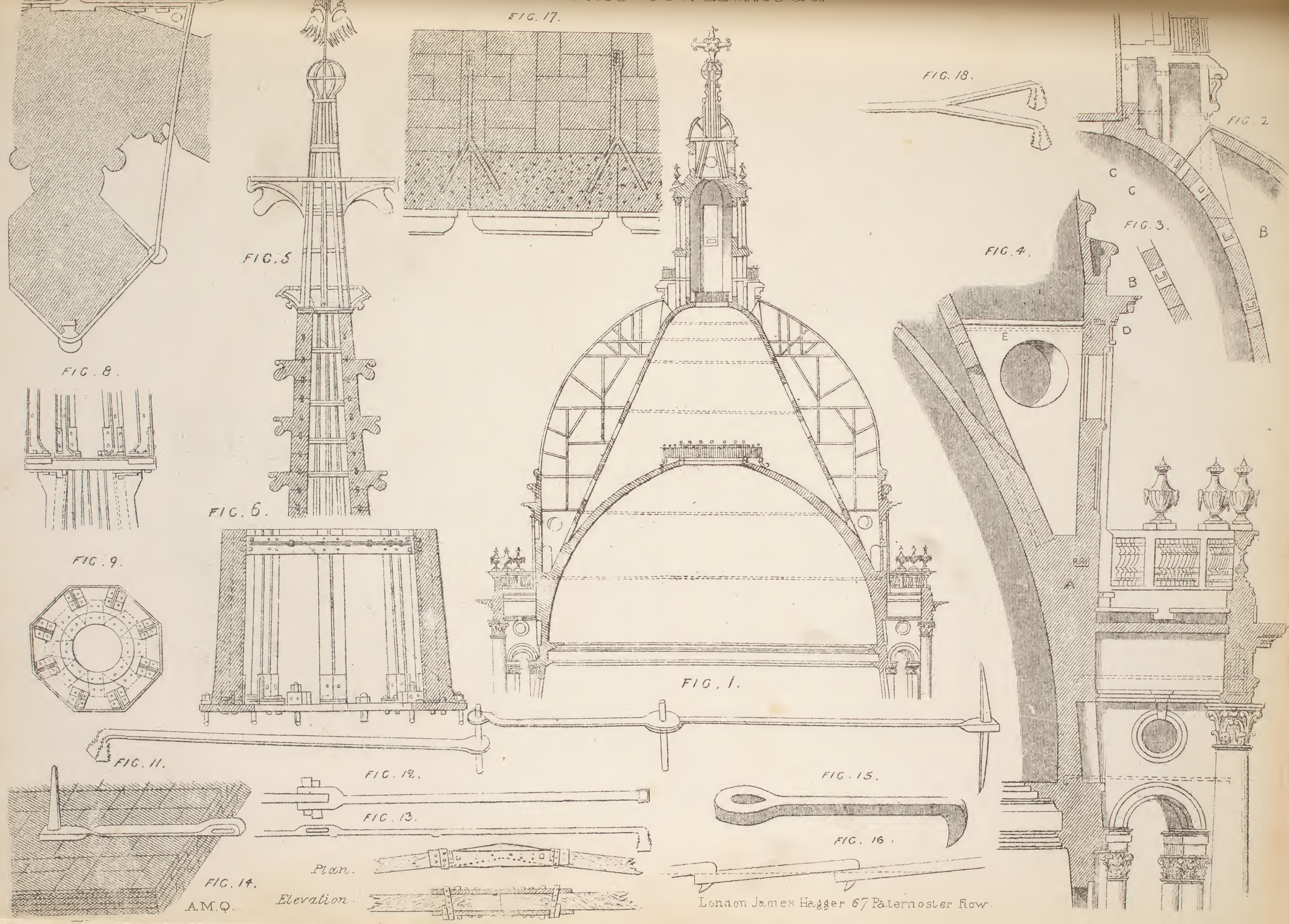
Figs. 23 and 24, the last in order of those given on this Plate, illustrate, by plan and section, a very interesting application of dowelling, in the case of the removal of the damaged arch-stones of Westminster Bridge and the insertion of sound ones in their room, according to a method adopted by Messrs. Walker and Burgess, and which, for ingenuity and general usefulness, is of great value.

As will be seen on reference to the figure, the damaged stones were cut out the whole breadth or thickness of the course, and the vacuity dressed fair; templets being then made to the exact shape, from which to work new stones. The latter, when so worked, were inserted in two thicknesses; the lower, *a*, or that nearest to the springing of the arch, being formed to radiate more, or to greater extent than the undisturbed portion of the original arch-stone; and the upper one, *b*, being slightly and correspondingly tapered, to enable it to be driven. Round holes were next sunk exactly opposite each other, in the two stones, to receive the dowel *e*, that in the lower being half the length of the dowel, that in the upper sufficiently deep to receive the whole dowel, and from the bottom of these holes or sinkings small channels were drilled each way to the chamfer on the face of the joints.

The stone, *a*, was then first set in mortar, and afterwards the stone *b*, an inserted dowel being held back during the latter operation in the larger vacuity formed in the stone *b*, by a cord attached to its either end, passing through the two stones from *c* to *d*, and tightened at *d*, until such latter stone was driven well home and firmly placed, when the cord, slackened at *d* and drawn at *c*, deposited the dowel to the extent of the half of its length, in the corresponding depth of the vacuity sunk in the lower stone *a;* cement being then injected through the channel *c* and *d*, to permanently fix it. The operation just described is shown in the upper part of the section, *Fig.* 23, as in progress, and in the lower portion as completed.

As the stones have a tendency to slip out until the cement hardens, a small tenon should be left on the under-side of the new stone, fitting a mortice in the masonry beneath, —indicated at *g*, in the wood-cut annexed,—and within six or eight courses on either side of the crown of the arch, a hard stone joggle (f, f, in Fig. 24, *Plate* 7, and in wood-cut annexed), about 4 inches long, and 2½ inches square, ought to be inserted in the old masonry at each end of the new work, in which a mortise to receive it should be wrought from the back of the stone, long enough to reach and fit tight up against the end of the

CRAMPING - DOWELLING &c.



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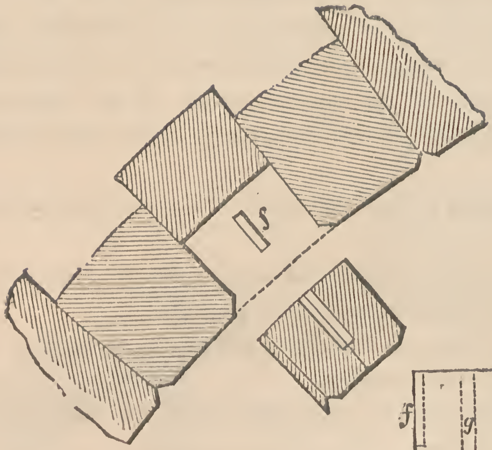
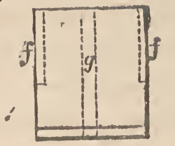
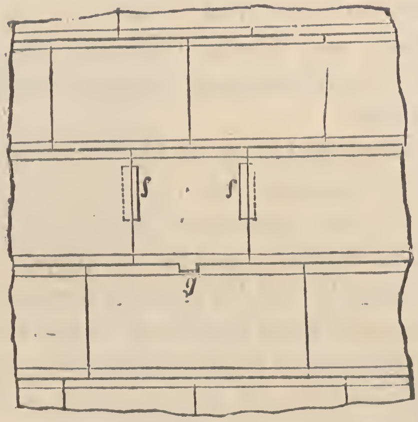
joggle; which latter should be kept short of the face of the work. so as not to be seen thereon.







It has been above said, that the use of iron should be avoided where practicable, for the purposes here illustrated, or if adopted, only in such situations as will allow of all exclusion of the air from contact with the metal so employed. Sir Christopher Wren * urges this latter point strongly, and says that "in cramping of stones no iron should lie within nine inches of air, if possible;" and he advocates the employment of strong mortar as the fixing medium, seeing, he says, that "it has been observed, in taking out cramps from stonework, at least four hundred years old, which were so crusted in mortar that the air was perfectly excluded, the iron appeared as fresh as from the forge." It might, however, be difficult, perhaps, in many cases, to find a substitute in other material, for chains or ties of iron, though wood has been used for a similar purpose (see *Fig.* 14, *Plate* 7[c]), where great lengths, or a curved, or other peculiar direction, is necessitated, as in the instance of the dome of St. Paul's, London, where such form very important constructive aids, and, probably, under the circumstances, the best and most suitable; as may be seen on reference to the section through this dome, given in *Plate* 7c, *Fig.* 4, where their nature and positions are exhibited, together with the other introductions of a similar kind also here employed: A being the main chain at the foot of the cupola, and B, B, B, B, and C, C, rings of stone, cramped together with iron. The first chain, A, in weight nearly five tons, is laid in lead, within a trough, or channel, cut for it in large blocks of Portland stone. The second, third, fourth, and fifth courses B, B, B, B, are built in, and form part of, the brick cone which covers the inner dome, and are formed of stone, cramped together with iron. The upper courses C, C, are likewise of stone, also cramped together in the same manner, the cramping being, in these instances, of lighter or less section.

* Parentalia.

Figs. 2, 3, and 4, are integral sectional details of the dome, &c., showing more at large the positions, &c., of these chains and rings; with that of another iron chain at D, surrounding the base of the outer cupola, and of the several other cramping or connecting irons, E, E, E.

On the same Plate, continuing the illustration of similar applications of the cramping and tying processes, *Figs*. 5, 6, 7, 8, and 9, are like sectional details, showing the method of framing and bracing with iron the various parts of the upper portion of the spire of St. Stephen's tower, at Vienna, a very interesting example of a free use of metal assistants of the kind.

Figs. 10, 11, 12, 13, 14, 15, and 16, are examples of iron chain-ties, of several descriptions, most frequently used.

Fig. 14, represents a wooden tie, inserted at the springing of a cupola at Florence; the use of which material for the purpose was incidentally alluded to at page 76.

Figs. 17 and 18, illustrate the application and form of a useful kind of cramp, similar to what the French describe as "*queue d'aronde*," or swallow-tailed.

In the next Plate, numbered 7^d, with the description of which observation on the subject will conclude, are shewn several of the more modern modes of cramping, &c., employed. Of these, Figs. 1, 2 and 3, exemplify the method of securing the stone-ashlering of a building, backed up with, or otherwise constructed of, brick, so as to allow for the usual settlement of the latter; *Fig*. 1, being a front section of the ashlar face, shewing the cramp fixed therein with cement; *Fig*. 2, a transverse section of the same, through the back bonding, or perpend, stone, &c., with an assumed settlement of the brickwork, indicated by the space *a*, *a*, left between the underside of the iron cramp and the upper surface of the bond-stone; and *Fig*. 3, a perspective representation of the cramp and pin.

Fig. 4, exhibits the application of an ordinary horizontal iron cramp.

Fig. 5, that of a vertical and horizontal conjoined cramp.

Fig. 6, is a geometrical section of the latter.

Fig. 7, shews, in elevation of the separated parts, a mode of dowelling the transom head and mullion of a plain Tudor window.

Fig. 8, is the plan of the mullion, shewing the orifice, A, for the dowel.

Fig. 9, elevation of part of the sill.

Fig. 10, perspective view of part of the sill, shewing the lower portion of the centre mullion, with its dowel inserted.

Fig. 11, a like perspective view, shewing, in the same manner, the side-mullion and dowel.

PLATE 7d

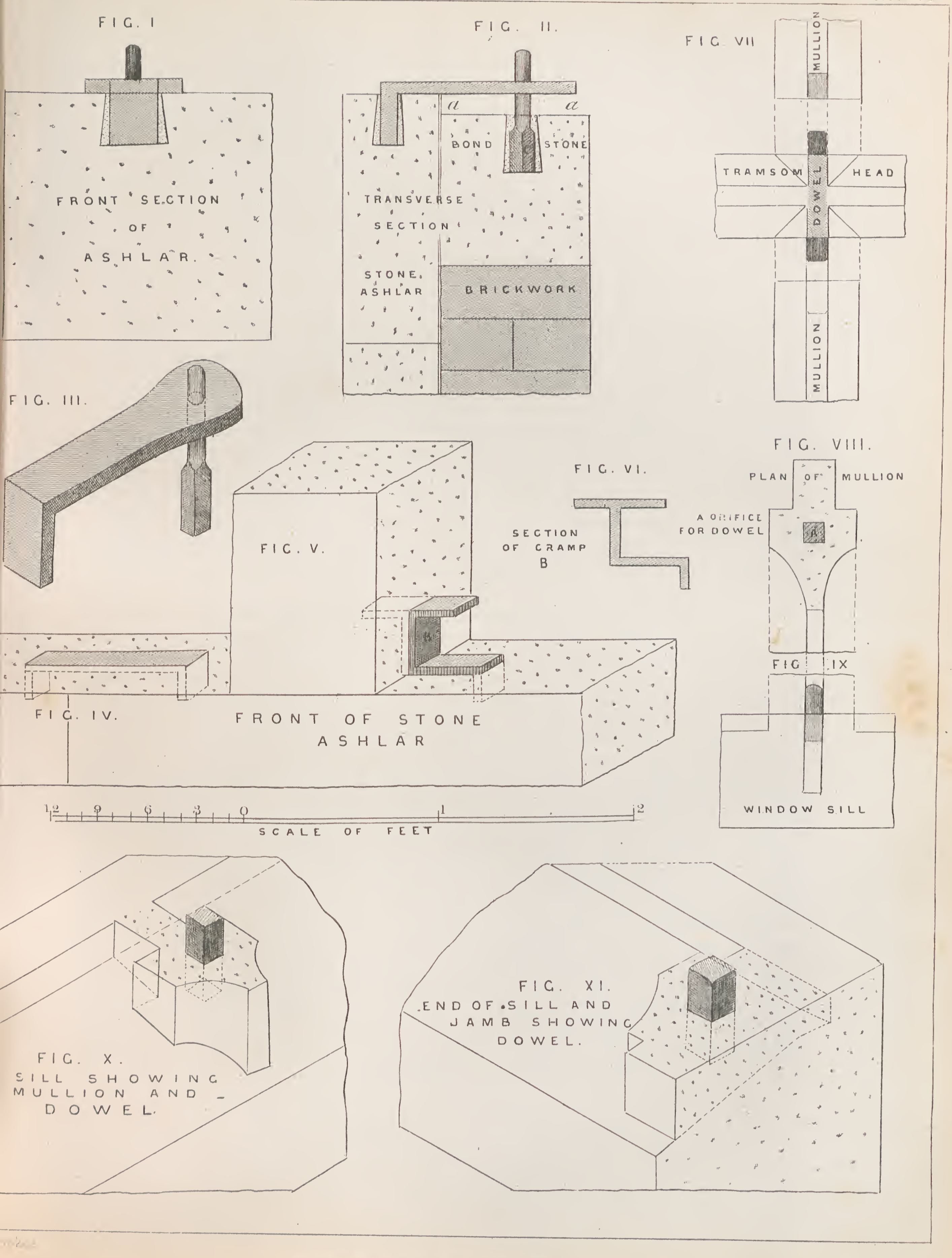


FIG. I
FRONT SECTION OF ASHLAR.
FIG. II.
a
a
BOND STONE
TRANSVERSE SECTION
STONE ASHLAR
BRICKWORK
FIG. VII
MULLION
TRAMSOM
HEAD
DOWEL
MULLION
FIG. III.
FIG. V.
FIG. VI.
SECTION OF CRAMP
B
FIG. VIII.
PLAN OF MULLION
A ORIFICE FOR DOWEL
A
FIG IX
FIG. IV.
FRONT OF STONE ASHLAR
WINDOW SILL
12 9 6 3 0 1 2
SCALE OF FEET
FIG. X.
SILL SHOWING MULLION AND DOWEL.
FIG. XI.
END OF SILL AND JAMB SHOWING DOWEL.

CHAPTER IX.

ON SPIRES.

In treating of the Spire, some authorities on masonry are disposed to place this feature of Mediæval Architecture in the same category with the Dome. The spire generally, however, exhibits but little of, if at all, the vaulted construction characteristic of the former; the same being, for the most part, simply a pyramidal or conical roof or termination, more or less acute, arranged constructively on the horizontal principle, as in the case of ordinary walling or such-like work.* The earlier examples evidence an origin in this source very distinctly; the later and more aspiring forms shewing merely the advancement of the vertical idea, ultimately resulting in the fully developed and perfected spire of the after period.

Among the earliest existing evidences of the stone spire† in what may be considered its first or incipient state, is that on the tower of Than Church, near Caen, in Normandy, which, with one at St. Contêt, also near Caen, are noticed in the Oxford Glossary. Another is also mentioned

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* Occasionally the spire appears to have been constructed differently, the beds of the stones being worked to a right angle with the inclination of the outer line of the spire; but the instances are not frequent. In modern practice the plan has been in some cases adopted, though open to the objection, perhaps, that it affords less security against the admission of wet at the joints than the more general method. In the stone roofs of porches and such-like buildings, the joints are frequently so placed, and to guard against such penetration of the weather, the same are sometimes rebated, as is exemplified in the porch given in Plate 16 and 16*a*.

† Spires or spire-like coverings of timber, it is considered, existed antecedently. The *Archæologia*, vol. xvii. p. 26, refers to an early use of such, and in Cædmon's *Paraphrase of the Book of Genesis*, preserved in the Bodleian Library at Oxford, of the age A.D. 1000, illustrated in *Archæologia*, vol. xxiv. plate 83, a square tower is shewn with a pointed spire of very elevated proportion, the timber construction and roof origin of which is, however, indicated clearly by its being shewn covered like the roof of the church to which it is attached, with shingle. The employment of timber in these early instances, whether viewed as denoting a spire or a roof covering, only shews the application of a material common to the architecture of the age; the character and appearance, as well as the adoption of which, was long after retained for a similar purpose. Many of the Norman stone spires shew the likeness of the tile or shingle covering of the earlier roofing of such features, as on the centre tower of Castor, in Northamptonshire; and on numerous Towers of far later date, the timber spire was retained or added, and has descended in several cases to the present day. Sutton St. Mary, Lincolnshire, has a spire of timber, with four smaller angle spires, or enlarged pinnacles, of the same material, at its base. Chesterfield, Derbyshire, has also a timber spire, and there are numerous similar examples among the smaller Churches, while some retain them of a form approaching more nearly to that of the earlier applications. East Meon, Hants—a Norman tower—is an instance. (See Wicke's *Spires and Towers*, p. 5, and Petit's *Church Architecture*, 2, 111.) Newhaven, Sussex, likewise retains an original finis. of a low timber spire. (See Wicke's p. 5, quoting Petit, in *Archæl. Journal*, vi., 138.)

in the same authority, as existing on the tower of the church of a small town, near Losches, in Touraine. The first is of the square form, as respects plan, usual in the earlier tower coverings from which the spire took rise, and differs but little from them except in altitude. The latter is octagonal on plan, the tower being, as was commonly the case, square, with an octagonal pinnacle on each corner, and an opening with a high pediment over it on each of the cardinal sides of the spire ; the character of the whole being late Norman.*

Very similar to this last mentioned, and of equal age, says the same authority, are the spires on the towers of the Church of Losches itself, though of plainer character, and with no openings in them, as in the other case, the one rising from an octagonal tower, which abroad appears a frequent plan, and the other from a square tower with, as in this case, octagonal pinnacles at the angles.

In our own country the more prevalent, and at the same time plainer form of spire first exhibited, is shadowed forth at Cleve Church, in Gloucestershire, and on one of the angle turrets of the west front of Rochester Cathedral. Both of these are noticed by Rickman, and there is a representation to a small scale of the latter in the "Oxford Glossary." The latter is circular on plan, but the covering or spire portion of the turret takes that of an octagon.† The more usual plan at this period, however, seems to have been the square.

The reference to this as the primitive and early roof form, is apparent in all the earlier examples of the spire. At Barnack, in Northamptonshire, probably one of the first English spires more strictly so distinguished, it is to be observed, though the spire itself exhibits mainly a similar arrangement and form to those of Losches just mentioned, rising not so immediately or directly as in other instances from the walls of the tower, but from a higher level, and out of what might be considered as the base of such a low pitched roof, or covering, as the tower would have shewn in the absence of such a feature as the spire, in this case super-imposed upon it. The majority of the earlier stone spires rise at once from and overhang the walls of the tower, following the practice adopted in their more ancient as well as coeval timber brethren, and the arrangement which is usually distinguished by the term of Broach.‡ At Barnack, as before remarked, this broach, or overhanging form, is preserved in the square plan and projecting section of what is to be taken strictly as its base, though possibly less in this instance than in some others which might be named, as in the latter examples, of Etton and Bythorpe, Hunts; to which occasion will be taken hereafter to refer more particularly. In other respects, and although thus partaking of, and shewing its original derivation, Barnacks differs from the more usual spires of its time; and it is probably the more interesting on this

* The spires of the Abbaye aux Hommes, at Caen, are of late Norman date; and St. Mary's, Jersey, one "which appears like a smaller and plainer version of these." Wicke's *Spires and Towers*, vol. ii. p. 3.

† At St. Peters, Oxford, a similar circular turret has the capping circular also.

‡ Strictly or properly used, the term *broach* signifies a pointed or piercing instrument. In Mediæval Architecture, it is applied to a spire which, distinguished from those which issue from behind a parapet or some intermediate finish on the upper part of the tower, overhang and rise at once from the walls, the angle spaces which are formed in the case of an octagon rising from a square, being covered by more or less inclined surfaces, called squinches, carried from the tower angles to the diagonal face of the octagon.

account.* The tower itself claims, and is usually considered as of Anglo-Saxon date, the spire being of the transition from Norman to Early English.

As will be seen on reference to *Plate* 8, *Fig.* 1, where a perspective of this spire is given, the latter, as has been before noticed, rises, octagonal on plan, from the spire which caps the tower, at a short distance above the eaves, from whence it continues vertically for some little distance in height—so far exhibiting the prototype, perhaps, of the lantern spires of later times—before the inclination or tapering of the spire portion begins. The four cardinal faces of this vertical portion have each a two-light circular-headed window, deeply recessed, and the four other sides each an attached pinnacle, in plan at this level rather more than a semi-octagon, which, issuing from above the salient angles of the tower capping, extends upwards beyond the point at which the raking line of the spire proper commences, and there finishes in the completed octagon; the same having been originally capped, probably, by smaller pyramidal terminations in character with the tower; the latter arrangement, or that of the angle pinnacles, exhibiting the first phase of one common to numerous other, and more elaborated specimens of the spire at a later period, in which such features posited upon the angles of the broach, in almost every variety of disposition, were frequently a very important feature.† The vertical portion terminates in a cornice or corbel table, from whence the spire rises to some height; its sides having a slight entasis, as the term is usually denominated in its application to classic architecture, or curved directions of their outline; in which it resembles other cœval examples, as well as a few of Decorated and perpendicular date. The spire of Bretteville l'Orgueilleuse, between Caen and Bayeux, in Normandy, is so constructed, as are the subsequent ones of Caythorpe, in Lincolnshire, and Wittering, in Northamptonshire.‡

It has been already observed,—and it will be useful to recur to it, for some of the finest spires are of this kind,—that the broach was the original form, arising out of the more primitive and ancient roof applied alike to towers and less elevated structures, whether of timber, as in the first more prevalent cases, or of stone, where such was afterwards employed. It has also been briefly stated that this origin and primæval shape is more or less retained in numerous instances. In some late ones, it is still very perceptible. Bythorne, in Huntingdonshire, of late Perpendicular date, has an octagon stone spire, rising from a square tower, in a manner very distinctively similar to that which, from a very early period, appears in erections of the same form in timber. In this case the tower finishes with a cornice, surmounting panelling of quartrefoils, sunk on each face, and carried round the tower, just below the point at which the raking angle of the diagonal face of the spire descends upon the tower angle; the cardinal

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* Something of a like early variation from the received form is to be observed in the Anglo-Saxon tower of Sompting, Sussex, which retaining, as is generally thought, its original capping, presents on each side a pointed gable, supporting a quadrangular spire, set diagonally to the tower; the former being, like Barnack, of later age than the latter, though unquestionably of very early date.

† A very extended list of these might be given. See general description of broach spires further on.

‡ *Oxford Glossary*, p. 347. *Note*, Fourth Edition, 1845.

remarked, are, both constructively and otherwise, of much interest to the masonic artist,—are, first, as the most simple, those of—

Barnwell, St. Andrew, Northamptonshire.—Early English. Spire plain and acute. Three ranges of spire lights Squinches small and depressed. Bold moulded eaves.

Warmington, St. Peter, North Hants.—Early English. Spire plain and depressed. Three tiers of spire-lights, the two lower richly gabled and crocketted. Squinches broad and depressed. Shallow dripping-eaves above a corbel table.

Witney, St. Mary, Oxfordshire.—Early English. Spire acute, with small angle-ribs. A tier of spire-lights at the foot, and small piercings midway of its height, from whence the thickness is slightly increased. Squinches depressed and canted to receive tall octagon pinnacles, issuing from their upper part. Bold corbelled cornice as eaves.

Bayeux Cathedral, Normandy.—Spire very acute, and banded. A range of very tall spire lights at the foot. Squinches very acute, and terminated with pinnacles, ranging with the pediments or gables of the spire-lights. Plain moulded eaves.

Ryhall, St. ———, Rutlandshire.—Decorated. Spire only moderately acute, divided by strings into three stages. Two tiers of spire-lights. Squinches broad and moderately depressed. Plain moulded overhanging eaves.

Raunceby, St. Peter, Lincolnshire.—Decorated. Spire plain, depressed, and massive. three tiers of spire-lights, the two upper small. Squinches large and high. Rich, blocked or corbelled cornice as eaves.

Luddington, St. Leonard, North Hants.—Decorated. Spire plain and acute. Two tier of spire-lights. Squinches small and depressed. Moulded overhanging eaves, with angle figures, serving as gurgoyles above sunk pannelling on each face of the tower.—Tower Early English.

Threckingham, St. Peter, Lincolnshire.—Decorated. Spire plain and acute, capped at apex. Three tier of spire-lights. Squinches broad and high. Carved and moulded eaves.

Ringstead, St. Mary, North Hants.—Decorated. Spire plain and acute. Three ranges spire-lights. Squinches large and acute. Corbelled or blocked eaves.

Aumsby, St. ———, Lincolnshire.—Decorated. Spire plain and depressed, capped at apex. Two tier of spire-lights. Squinches large and high. Plain moulded eaves, with angle gurgoyles.

Cheltenham, St. Mary, Gloucestershire.—Decorated. Spire acute, angle-ribbed. Two ranges of spire-lights. Squinches depressed. Moulded dripping-eaves.*

Southam, St. James, Warwickshire. — Decorated. Spire acute, separated into three heights or stages. Two tier of spire-lights, commencing midway. Squinches moderately

* The above character in all respects distinguishes the wooden spire of Almondsbury church, in the same county; the spire-lights, however, being omitted.

acute, with tall square pinnacles issuing from near their apex. Corbelled cornice at foot as eaves.

Woolaston, St. Mary, Northamptonshire. — Decorated. Spire moderately acute, angle-ribbed. Three tier of spire-lights. Squinches broad and depressed, with octagon angle pinnacles issuing from their base.

Raunds, St. Peter, Northamptonshire.—Early English. Spire plain and acute. Three tier of spire-lights. Squinches plain and acute.—Tower Early English.

Desborough, St. Giles, Northamptonshire.— Perpendicular. Spire plain and acute Two tier of spire-lights. Squinches moderately acute, with angle canted off, and connected by an embattled parapet, with small octagon angle pinnacles issuing from the base. Moulded cornice as eaves.

Bythorne, St. Lawrence.—Perpendicular. Spire plain and acute. Three tier of spire-lights. No squinches. The cardinal faces of the tower carried up to meet the octagon. The diagonal faces of spire sloped down to the tower-angle. Moulded cornice as eaves.

Of a less plain form are those of :—

Ketton, St. Mary, Rutlandshire. — Decorated. Spire very acute and angle-ribbed. Three tier of crocketted spire-lights. Squinches angle-ribbed and acute, finishing with small statues under canopies.—Tower Early English, with a corbel-table finish.

Market Harborough, St. Denis, Leicestershire.—Decorated. Spire moderately acute, angle-ribbed and crocketted. Two ranges of small spire-lights. Squinches small and moderately depressed. Plain moulded eaves.

Walcot, St. Nicholas, Lincolnshire.—Late Decorated or Early Perpendicular. Spire very acute, angle-ribbed and crocketted, with bold moulded eaves. Three tier of crocketted spire-lights. Squinches large and very acute.

Stamford, St. Mary, Lincolnshire. — Spire acute and angle-ribbed. Three tier of crocketted spire-lights. Squinches moderately acute, finished with figures in small niches formed in the diagonal faces.—Tower Early English.

Newark, St. Mary Magdalen, Nottinghamshire.—Decorated. Spire acute and angle-ribbed. Four tier of crocketted spire-lights. Squinches also angle-ribbed and very acute, with octagon turrets, conically capped, issuing from their base, and connected by a pierced parapet above. Moulded and enriched cornice as eaves.*

Anwick, St. Edith, Lincolnshire. — Decorated. Spire plain and depressed. Three tier of spire-lights, enriched with figures as gurgoyles at foot, and finials at the points.

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* At Aylstone and some other Lincolnshire examples, the broach spire "is connected with a sort of parapet," and "at Denford, Northamptonshire, with a parapet and pinnacles at the angles," (Wicke's *Spires and Towers*, p. 6, vol. ii.,) in a similar manner to that at Newark. Christ Church, Oxford, has a variety of the broach, with angle turrets and pinnacles.

Squinches broad and high, finished with gurgoyle figures. Enriched moulded overhanging eaves.

Keystone, St. John Baptist.—Perpendicular. Spire very acute and plain. Three tier of spire-lights. Squinches plain and acute, terminating in a small shaft and cap.

To the above may be added several other spires of the broach description, more or less deserving of careful attention. Wandsford, St. ———, and Polebrook, All Saints, have broach spires of Early English date; the former moderately acute, with large squinches, the latter less so, with overhanging eaves. Gaddesby, St. Michael, Leicestershire, is a good example of a simple Decorated spire, of the Northamptonshire type. Wellingborough, All Saints, another, earlier in the style and more massive, having ribbed angles and octagon pinnacles on squinches, comparatively small and depressed, with two tier spire-lights—one at base, and the other in upper part of the spire. Sleaford spire is a broach, with very tall or acute squinches, and Backworth, Hunts, also; the squinches of the latter being larger, and showing the remains of the pinnacles formerly posited thereon. Ewerby, Leicestershire, and Olney Buckinghamshire, have spires of this kind and date, both very acute; the former plain, with very large squinches, the latter ribbed, with the squinches small, and also carrying pinnacles. Barkby, Leicestershire, has also a good Decorated broach on a small scale. Irchester, North Hants, has a lofty plain broach, with small squinches.* Oadby, Leicestershire, has a Decorated spire of massive proportion. There are also others at Shurdington, Bisley, Stroud, and Standish, in Gloucestershire, in all of which the spires are very acute, and the squinches small, with overhanging eaves of very simple kind. That at Standish, with the one at Shurdington are given in Petit's *Architectural Character.*

Among the Perpendicular broach spires are, South Kilworth, Geddington, Braybrooke, Brompton, Spaldwick, Hunts, St. Alkmunds, Shrewsbury, and Stanion. Of other varieties of the stone spire of different dates a very extended list might be given. It may be sufficient, however, to mention a few of the principal, or most considerable. Exhibiting the transition from the broach to the immediately succeeding form, are those of Denford† and Woodford. Rather more advanced are, Grantham, Newark, and (before noticed) Heckington; to which may be added that of Oakham, All Saints, Leverington, and Adderbury. Of the succeeding form, in which the spire is connected with, and rises from among turrets and pinnacles at its base, are those of Chichester, Salisbury, Peterborough (south-western spire), and Oxford, St. Mary's. Among the less ornate and more general, in which the broach character no longer prevails, are, Wigton, St. ———, Leicestershire; Shottesbrooke, Berks; Slymbridge, Gloucestershire; St. Sepulchre, Northampton; and Finedon. Trent, St.———, Somersetshire, is a fine example of this class. Piddington is an instance of a Decorated spire, rising from within an octagon. Bloxham, Oxfordshire, also Decorated, shows a spire rising from an octagon stage, with an extremely rich parapet. Of this latter kind, of Perpendicular date, are, of the smaller or inferior order, Brayton, Yorkshire; Swineshead, Lincolnshire; and, again,

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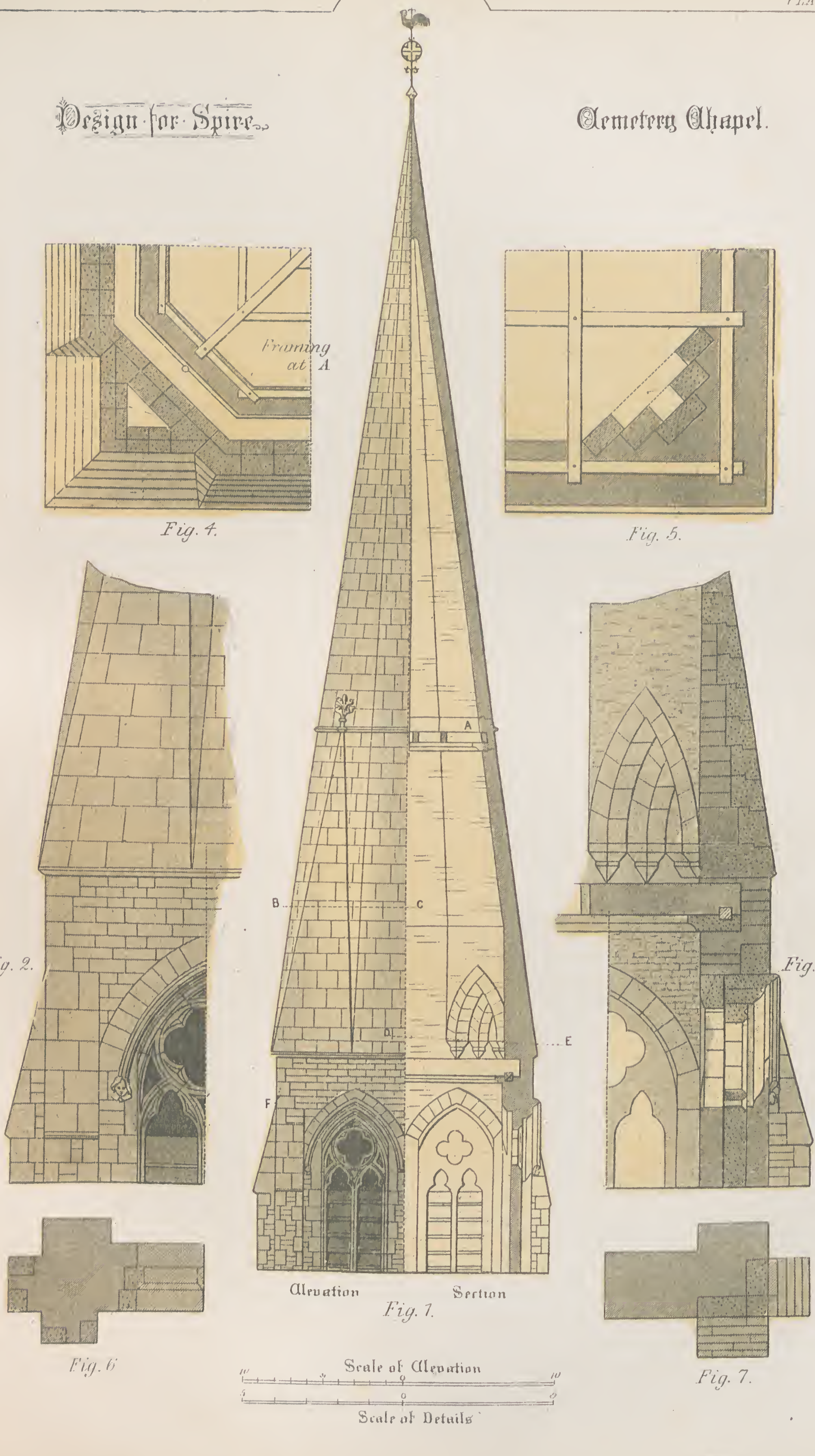
* Poole's *Northamptonshire Churches.*

† *Northamptonshire Churches*—A view given in Johnson's *Reliques of Ancient English Architecture.*

Design for Spire — Cemetery Chapel



London. James Hagger, 67, Paternoster Row

Referring to this latter point, or that of the construction of the spire, it may be here remarked that the latter generally, speaking with reference to old examples, do not appear to be dependent on any adventitious aid as regards the jointing, or connexion, of the several stones of which they are composed. Their security seems rather to be the result of an accurate working of the beds and vertical joints, and the adhesion of naturally good and properly-applied mortar. The dowelling and cramping processes, at least as far as most observation has extended, are not apparent in them. In modern work it is questionable, however, whether such aids should be altogether dispensed with, or whether it be now safe to depend solely upon the old system of operation; and under this impression it may be well to notice some of the methods occasionally employed in present practice to steady and tie in the spire. One of these is that of the insertion of an intermediate stage, or floor, of timber-frame, connected with its structure, as exhibited in *Plate* 8*a*, *Figs.* 1 and 4; the first shewing a section of such stage, marked A, and the latter its plan.

This example was designed for a mortuary chapel, but the same principle and arrangements are applicable to similar works of more extended nature. As will be seen, it is of the broach kind, and of Decorated character; *Fig.* 1, shewing on one side a half elevation, and on the other a half section of the whole height of the spire, with a portion of the upper part of the tower from which it rises.

Fig. 2, is an enlarged elevation of the lower part, shewing one of the squinches, and a portion of the head of one of the belfry windows, with the upper tabling of the buttresses.

Fig. 3, is an enlarged section through a corresponding portion, shewing, in elevation, the discharging arches, with their corbels or springers, which carry the canted or diagonal faces of the spire, and, sectionally, a portion of one of the cardinal faces, with the floor, or binding stage, at the base of the spire. In this section, the method before alluded to as sometimes adopted in modern works, of rebating the beds, is shewn; a practice, however, involving considerable extra labour, though of questionable utility.

Fig. 4, is a plan or horizontal section of the spire, taken on the line B. C. on the half elevation, looking upwards and shewing a like horizontal section at the higher level of the intermediate stage A, before mentioned.

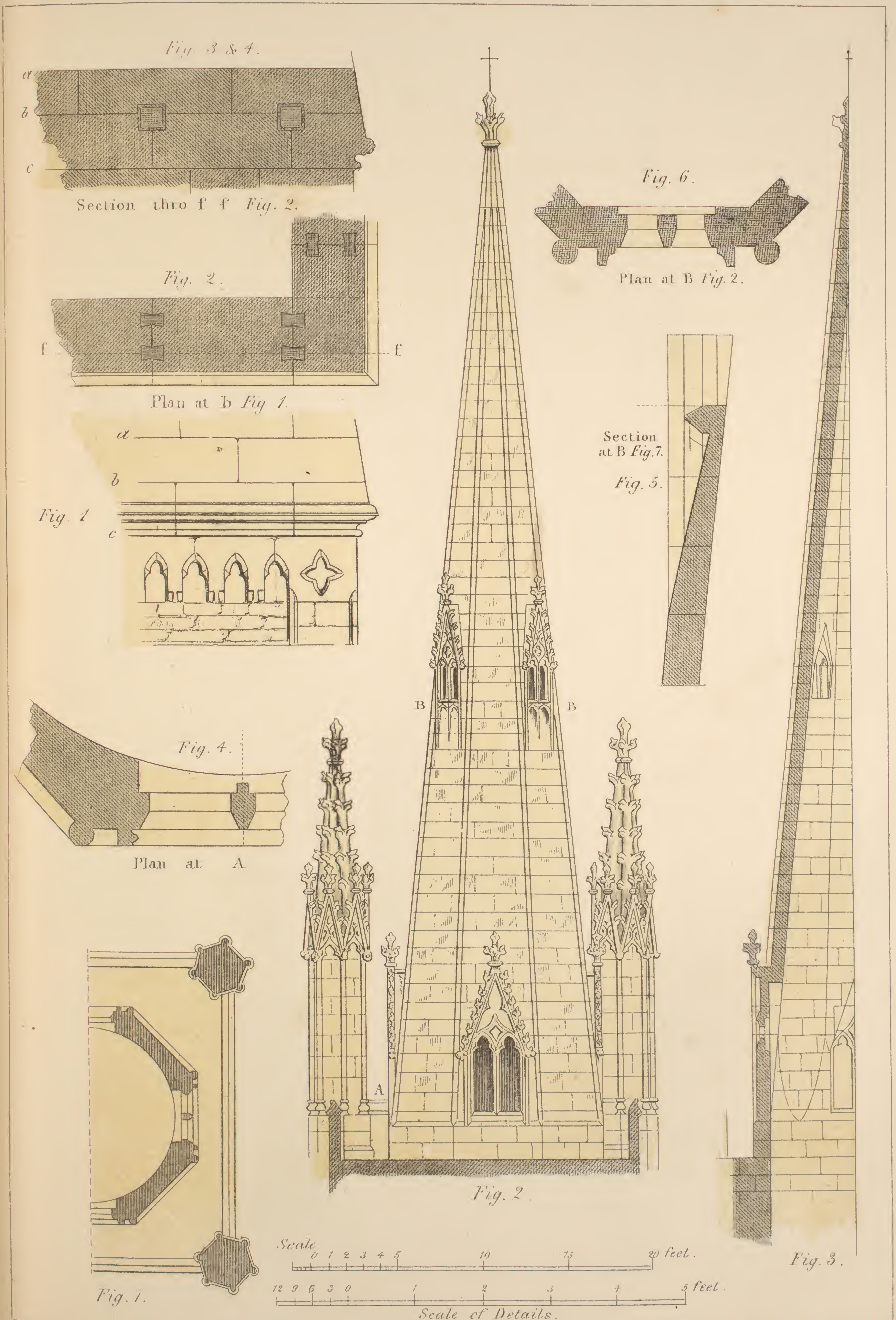
Fig. 5, is the plan of the lower part, or base, of the spire, taken on the line E. E., *Fig.* 1, shewing the naked framing of the bonding stage at this level, and the arrangement of the stones forming the angle arches.

Fig. 6, is a section through the angle buttresses of the tower below the upper tabling, shewing the quoining stones; the main construction being presumed to be rubble, or random coursed masonry, and *Fig.* 7, a section through the tower wall at F, on the elevation, looking down on the buttress caps, and shewing their connexion with the tower wall.

Further contrivances for security, and means for preventing injury from the action of heavy winds, &c., have been sometimes introduced. In the case of the rebuilding, by Sir Christopher Wren, of the upper part of the spire of Chichester Cathedral, which had been forced from the upright by some such cause, two intermediate stages, connected with a pendent beam of timber, about 80 feet long, attached to the finial stone, each about three

SPIRES—DECORATED.

PLATE 8b.



D. Ruddle. Archt. Delt.

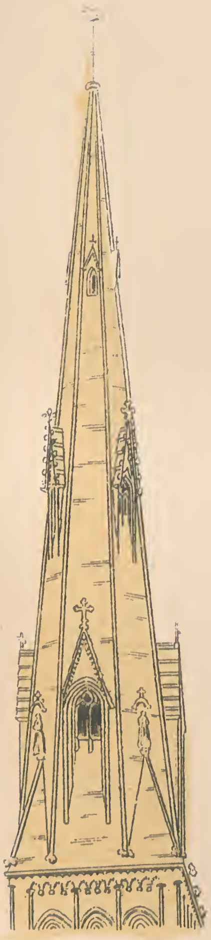
London James Hagger, 67, Paternoster Row.

Raunds.

Fig. 1

Wellingboro.

Fig. 2

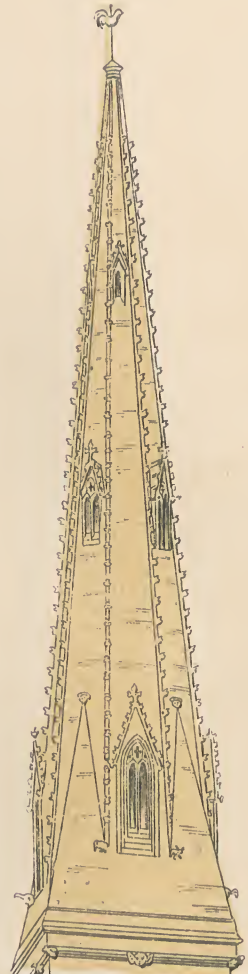


Kelton.

Fig. 3

Threckingham.

Fig. 5

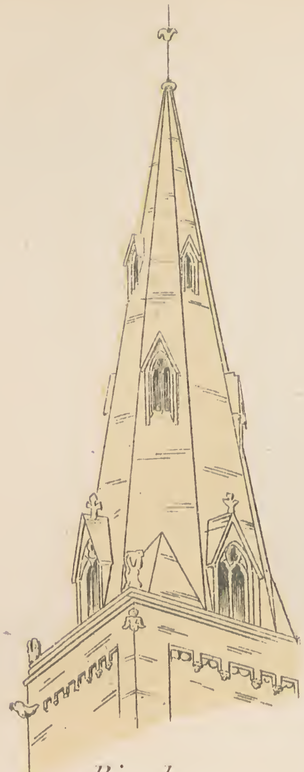


Walcot.

Fig. 4

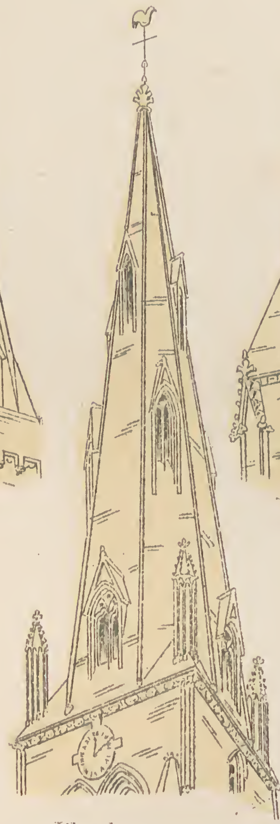
Fig. 6 Warmington

Ryhall. Fig. 7

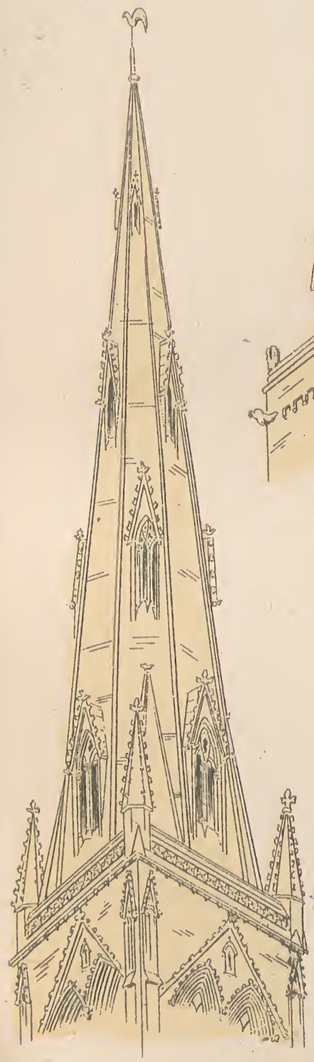


Bingham.
Fig. 12.

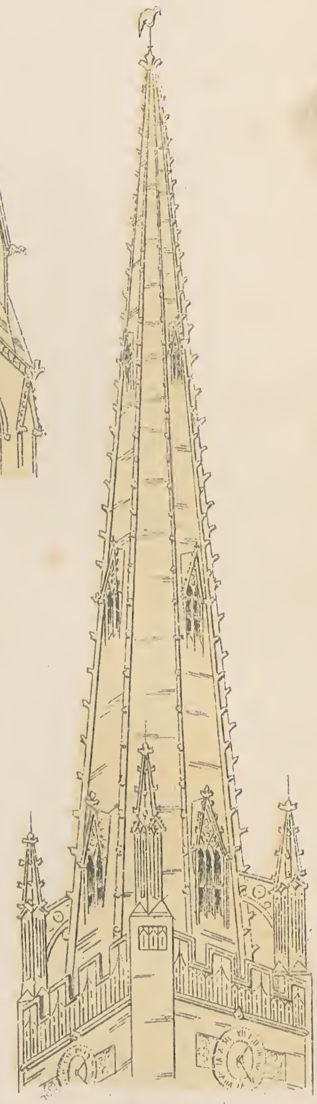
Anwick.
Fig 8.



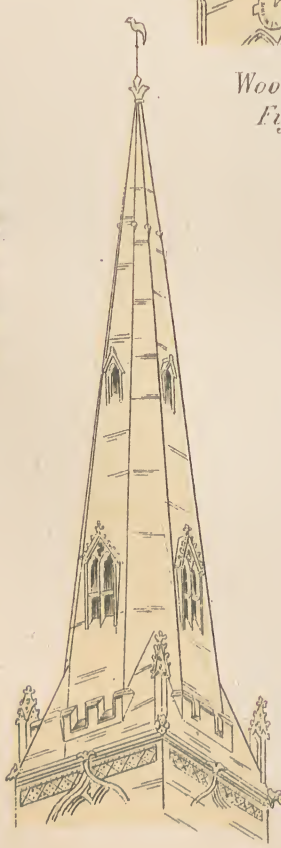
Woolaston.
Fig. 10.



Newark.
Fig. 13.



Whittlesea.
Fig 14.



Desborough.
Fig. 11.

Southam.
Fig 9.

thickness of the tower wall, the spire rises to the height of 61 feet, terminating with a floriated finial of eight leaves, surmounted by an iron cross. It is octagonal on plan, and the angles are ribbed with a roll moulding of about 4 inches diameter. There are four spire-lights at the foot of the spire on the cardinal sides of it, and four others at about mid-height on the diagonal, or intermediate, faces. They have all crocketted gables and pierced tracery, and the upper ones have tracery also under their cill, for which a sufficient depth is obtained by sinking back the face of the spire from the springing point, or issue of the jamb, to the under side of the cill, as shewn in the *Fig.* 5.

Fig. 6, is a plan of these upper lights, taken at the level of the upper surface of the cill, *b* in elevation *Fig.* 2, and section *Fig.* 5. *Fig.* 4, is a like plan of the lower spire-lights, taken at the level marked *a* on the elevation.

The detail, as will be seen, is simple and bold. The lower angles, it is to be added, have each an hexagonal pinnacle of the same date as the spire, which, however, rises quite independently of them.

With these observations, and a description of *Plates* 8*c* and 8*d*, in which several of the more usual forms of the spire are perspectively represented for the purposes of ready and comparative reference, the notice of this particular feature in constructive masonry may be concluded.

Referring therefore to these last-mentioned *Plates*, *Figs.* 1, 2, 3, 4, and 5, represent the broach-spires of Raunds, North Hants; Wellingborough, in the same county; Ketton, in Rutlandshire; and Walcot and Threckingham, in Lincolnshire.

These are, as will be perceived, of the acutely pointed form; *Fig.* 1, having the moderately depressed squinch, *Fig.* 2, the low form of the latter, and *Figs.* 3, 4, and 5, the more elevated.

Figs. 6, 7, and 8, respectively from Warmington, North Hants, Ryhall, and Anwick, exhibit the less pointed forms of the broach, such as are common to most of the Northamptonshire specimens, with large or broad squinches.

Figs. 9, 10, and 11 shew the broach-spire associated with pinnacles on the squinches and at their angles, with and without a connecting parapet. *Figs.* 9, from Southam, Warwickshire, and 10, from Woollaston, North Hants, being of the former description, and *Fig.* 11, from Desborough, of the latter.

Figs. 12, 13, and 14, shew varieties of the later character. The first, from Bingham, Nottinghamshire (an early example), a spire rising simply from behind, and independent of any connexion with a surrounding parapet, which forms the termination of the tower; as in the example from Peterborough, given in *Plate* 8*b*. The second, from Newark, shews the spire connected with the parapet by pinnacles and other attached features; and the third, from Whittlesea, Cambridgeshire, the similar character of spire, further assisted and distinguished in the way of attachment, by flying buttresses from the tower pinnacles.

Of these several examples, *Figs.* 2, 5, 6, and 12, are of Early English date, presenting good and readily applicable models, as respects principle and character.

only as respects the exposition of his own, such as they may be, but of the ideas of others who may seek his executive aid.

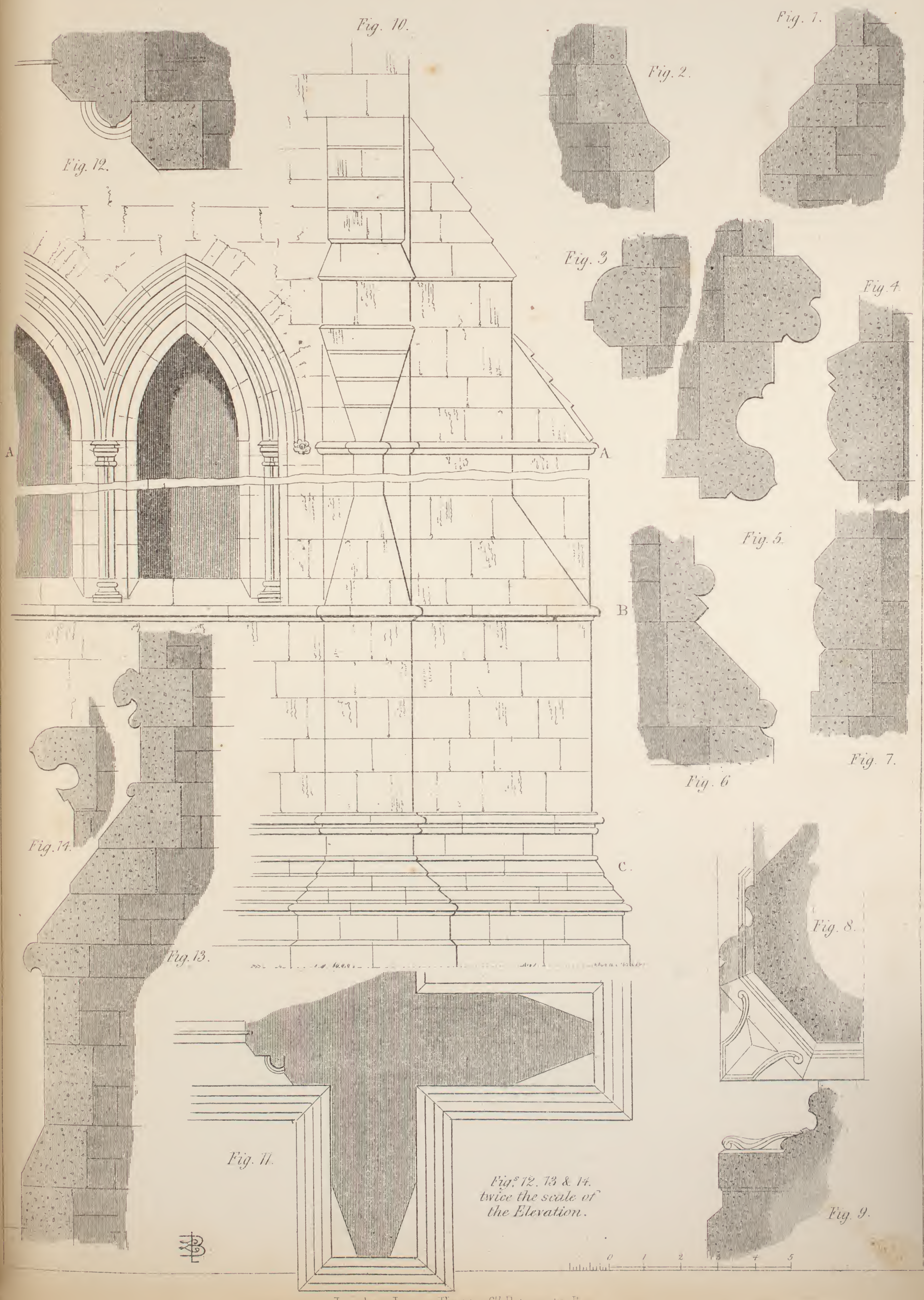
These observations have been considered necessary to account for the introduction of illustration other than simply practical, not only with respect to the subject of the present chapter, but of that of any other part of the work to which they may either incidentally or directly apply. The main object of it is, undoubtedly, practical, but, at the same time, it would be of far less utility than is clearly necessary, or than it should be made, were the theory and the artistic bearings of masonic operations less cared for and entered upon.

Proceeding, then, it may be stated that classic architecture shows no employment of the buttress, viewed in relation to its real properties and after appearances. The nearest approach to the feature, as it was exhibited in the first, or debased, forms which originated in and succeeded the more ancient and purer styles, may be considered to be represented in the case of Greek architecture in the antæ of their temples, and in Roman architecture in the pilasters frequently attached to the walls. The former, however, are probably only the representations of the timber angle posts of the original types, and the latter generally mere matters of ornamentation; in neither case performing the legitimate functions of the after buttresses, or that of a counteracting force to lateral thrust.

The earliest buttresses, distinctively viewed as such, are, with relation to their first appearance in mediæval architecture, of that description usually denominated Norman; being generally plain broad faces, with but little projection in advance of the walls to which they are attached; the surfaces of the latter intermediate between them, appearing, in many cases, more like recesses in the general thickness, represented by the buttress in connexion with the corbel table or parapet above, into the plane of which they frequently die, than as additional supporting projections. Sometimes they finish before reaching the parapet, in a plain slope, under which arrangement they approximate more nearly to their proper character. They usually continue in one and the same width and substance from base to top, not being commonly divided into stages, as in later examples; in which the qualities of more nicely calculated resistance, as associated with the different constructive principle employed in the main forms, were involved. Occasionally, however, a second or subservient face, less broad, is placed upon the first, and sometimes these additions are semi-circular, instead of rectangular, projections upon the former.* Other varieties of treatment are also observable in some of the later examples. In some of the richer buildings of Norman age, the angles of the buttresses are worked as shafts, in some with, and in others without, caps and bases. Two examples of this description are given in the Oxford Glossary, plate 21, one from Glastonbury Abbey, of the date A.D. 1200; and another from St. Mary's Abbey, Leicestershire, circa 1160. The faces of some are also ornamented with ranges of small arches, in addition to the angle shafts; the general character and expression is, however, rather that of the thickened pier, than the graduated supports afterwards necessitated and

* See *Oxford Glossary*, instancing the keep of the Castle of Loches, in Touraine.

Norman and Early English.



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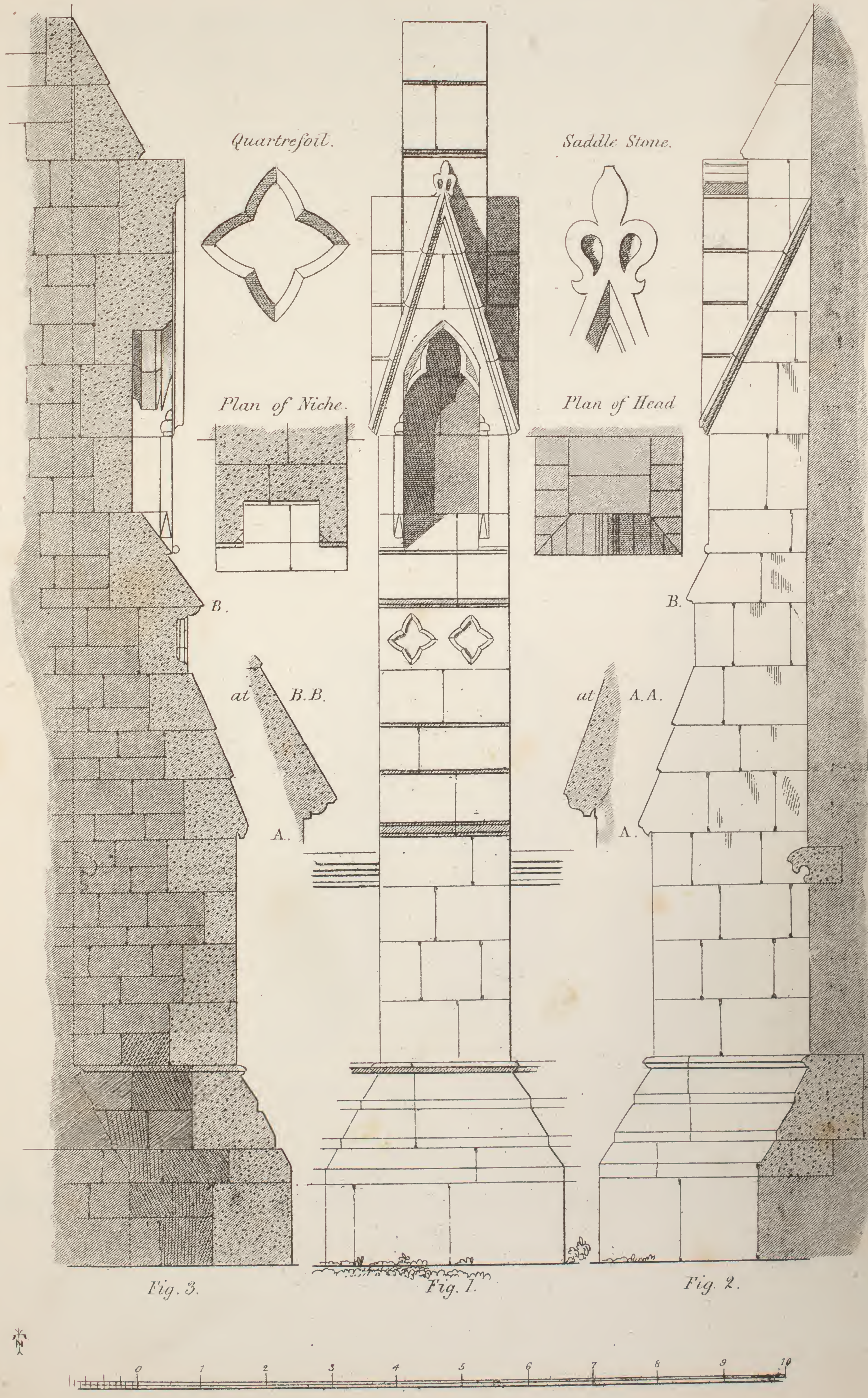
the latter, and tabled back upon the second or upper stage, the angles being canted so as to reduce its face, for nearly its whole height, to about 9 inches, when it returns again to the original breadth of 2 feet 4 inches, and thence dies into the church-wall, in a tabling of five plain slopes. The nature of this arrangement will be clearly seen on reference to the plate, where sectional details of the several mouldings, with a plan of the buttress, is also given. (See *Figs.* 5, 6, 7, &c.) Another, before noticed as of narrow face, and sometimes attached to the broad flat buttress of this and the Norman time, occurs at St. Mary's, Stamford. It is of four stages, the angles chamfered, all tabled with plain slopes, and projects from the face of the main buttress of the tower about one and a half the width of its face; the tower strings, wherever they occur, being continued over it. The upper slope dies into the tower immediately beneath the Belfry stage.

The pedimented or gabled buttress of the Early English period is exhibited in several varieties at Salisbury. One of three stages, with good base mould, and tablings of plain slopes, and a plain gabled head finishing in the parapet, the angles stop-chamfered on the two upper stages, is given in the Oxford Glossary. It also occurs at Donington, in Lincolnshire; and instances of it in the Decorated period are numerous. Heckington Chancel, Lincolnshire, has some good pedimented buttresses of the kind, and also Aumsby, in the same county.

Of the Early English pedimented buttress, which, differing from the last mentioned, have their terminating gable above the parapet, there are many examples. Some at St. Mary Overy, Southwark, are very interesting and bold, and at Lincoln are others equally so. The latter are among the earlier examples of the flying buttress, of which there is a curious illustration, also, at Hartlepool, near Durham, figured in *Plate 22* of the Oxford Glossary. This example is of a not very common character. The lower portion shews as a buttress of very extended projection, and narrow face, with chamfered angles. The base mould is a plain splay, and there is a horizontal string midway in the height of the first stage, which, raking up at an acute angle against the church wall, is covered, instead of the usual tablings, with a moulded capping, the breadth of the buttress, the front face of the latter having a pedimented gable to mark its primary or lower division. From behind this gable here mentioned a second stage, standing wholly detached and unconnected as a square shaft, its depth being no greater than the width of its face, which agrees with that of the lower stage, rises and receives the flying portion, above its junction with which, it is capped with a pedimented head of the usual description, as a termination. The flying arch has a plain soffit, and is covered with a moulded capping, as common in the later instances, to match the lower part.

Other varieties of the Early English flying buttress are presented at Salisbury and at Chichester. Both of these edifices exhibit some very fine and valuable examples. Some highly interesting ones are also to be met with in the contemporary architecture of the Continent.

In the Decorated buttress the projection, varying from the greater number of the Early English, is largely increased, and the breadth of the faces greatly reduced. They are also commonly graduated or separated into a number of stages; a frequent ornament of the intermediate, and a common termination of the upper slopes being the triangular or gabled



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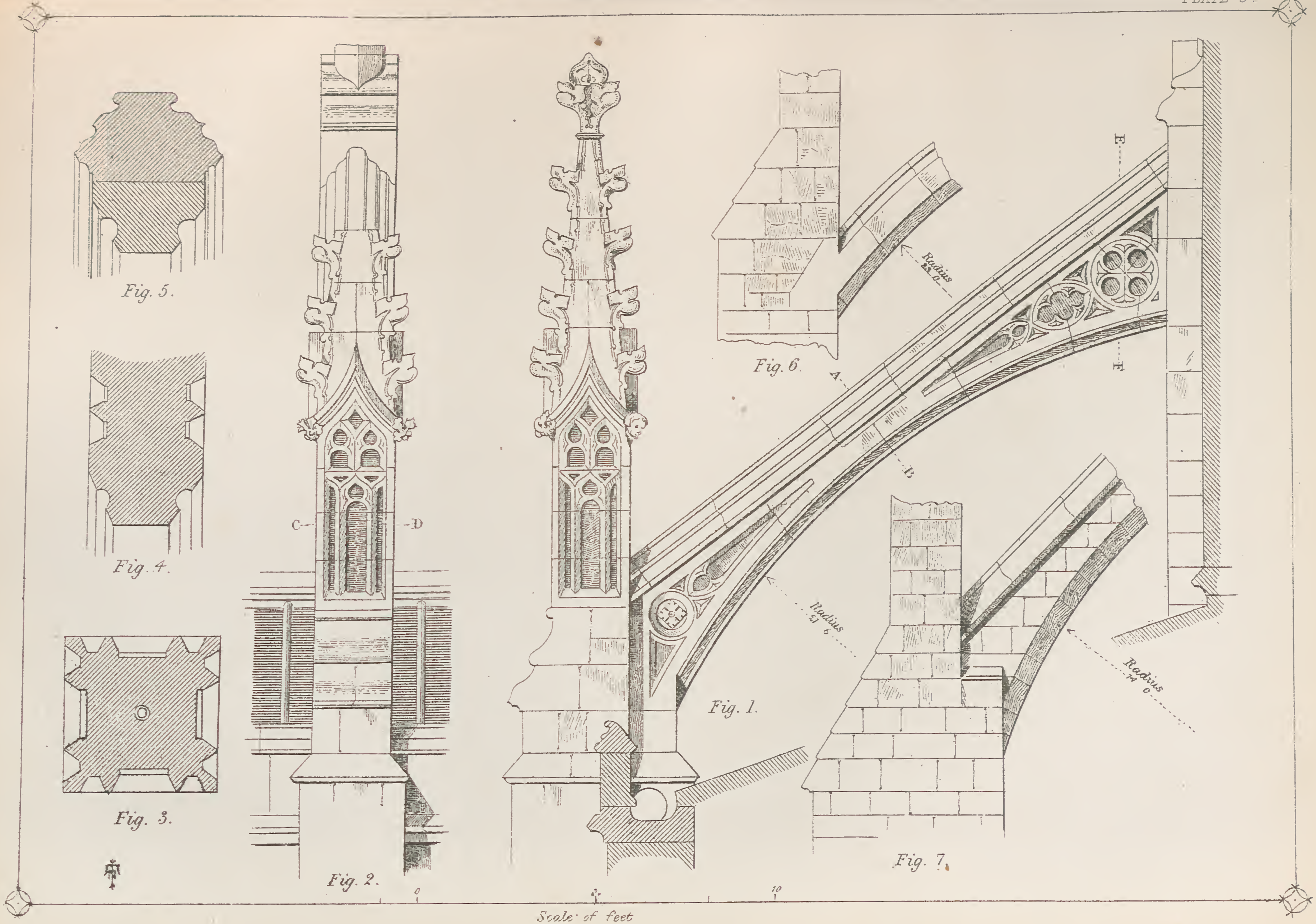
BUTTRESSES.—FLYING.



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flying buttresses of the spire; and the same thing occurs at Caythorpe, in the same county, and in a number of other cases. In the next style the pinnacled terminations and enrichment of the buttresses, whether flying or otherwise, are almost without number.

In *Plate* 9, as will be seen on referring to it, the Early English angle buttress of the Choir of Southwell Minster has been given; *Fig.* 10 shewing the elevation, *Fig.* 11, the plan taken at A A, and *Figs.* 13 and 14, portions of the details at large of the mouldings; that is to say, *Fig.* 13, a section of the string at B, and *Fig.* 14, a section through the base moulding C. *Figs.* 12 a plan of the window mullion and jaumb.

On the same plate are also shewn sectional details of some of the most common forms of Norman tablings and strings, with a base mould of transitional date.

Figs. 1 and 2, represent a Norman buttress tabling, and set off, respectively, from St. Cross, Hants, and Monks-Horton, in Kent.

Figs. 3 and 4, are strings, the former from Treton Church, Yorkshire, the latter from that of Adel, in the same county.

Fig. 5, is a label, with part of the jaumb of the north door of Carisbrook Church, Hants.

Figs. 6 and 7, are base mouldings, the first from York Minster, and the latter from Adel, before mentioned. These two latter are from Rickman.

Fig. 8, is the plan above, and a section through the base, of one of the columns of the Choir, at Canterbury. And

Fig. 9, is a similar section of the base mould and plinth, viewed diagonally, or on the angle, showing the ornament on the flat of the same. The bases of these columns are very interesting examples of late or transitional Norman work.

In *Plate* 9*a*, a Decorated buttress is represented, of which a detailed description has been before given (see page 94), when observing on the buttresses of this period. In *Plate* 9*b*, continuing the consideration of those of the succeeding date, is a Perpendicular flying buttress, with the detail for its construction. As this, and the various Perpendicular details, with reference to buttresses, given on *Plate* 9*c*, will convey a sufficient notion of the main points on which the Mason might, with constructive reference, or otherwise, be desirous of being informed, it has been deemed unnecessary to extend illustration to the graphic representation of other forms of the Perpendicular buttress, or to such as are separated from, or divested of, such feature as the flying portion. The later Decorated may be taken to include and exhibit all the main principles of construction, as well as the general appearance, common to the greater number of the earlier buttresses of the next age; while the latter represent chiefly differences on the score of the detail, the general arrangements being the same, and modified only to suit a more or less ornate character, or the growing tendency towards a return, in the general Architecture of the period, to a more depressed form than had previously prevailed. Rickman says, speaking of the buttresses of this age, that they "differ very little from those of the last style, except that triangular heads to the stages are much less used, the sets off being more often bold projections of plain slopes. In the upper story," he continues, "the buttresses are often very thin, and have diagonal faces." This occurs frequently in the clerestories of the large perpendicular churches of Norfolk and Suffolk. They so appear,

among the rest, at Southwold and at Blythborough, in the latter county. "There are few buildings," he adds, "of this style without buttresses," and "all the kinds are occasionally ornamented with statuary niches, and canopies of various descriptions," as at Gloucester, &c. Some buttresses, although pinnacles are the common finish, terminate in a square shaft, without any. Those of St. George's, Windsor, and the Beauchamp Chapel, at Warwick, finish in this manner. At Blythborough, the upper buttresses are similar, having a kind of cornice, on the flat above which, seated figures are placed as terminations. At Peterborough, some have statues of saints in like manner as pinnacles. At Southwold, Suffolk, before mentioned, and in some of the Norwich Churches, the plain square shaft and a cornice capping is exhibited.

There is one distinguishing mark in perpendicular buttresses, however, which it would be, perhaps, improper to omit a mention of, though more strictly a matter of ornamental Masonry. This is the pannelled introductions on the faces and other parts. These, as in the case of fan-groining, are frequently worked as moulded work, from the solid of the stone with which the buttress is faced, or otherwise built, and in so far agrees with the general pannelled arrangement of many Perpendicular features and constructions.* In others, and particularly in the later flint churches of the eastern counties, the buttress faces, in common with those of the plinths and other parts of the walls, have the stone work simply rough sunk, and filled in with flint work, the outlines of tracery and other ornament being simply represented in otherwise un-sunk stone. In the ruins of Covehithe and Walberswick Churches, Suffolk, the plinths are throughout so worked, as have been the buttress fronts. At North Walsham, in Norfolk, the porch is faced in like manner,† and a list of the churches in which this treatment is visible would be almost without end. In some rich examples of this kind of masonry, the moulded work, and this, which may be called plain sunk work, are jointly used. The fronts of the south porch, and the western face of the tower of Southwold Church, are a rich example of this mixture, as is also the Erpingham Gate, at Norwich. In the case of long lengths of buttress face, it is to be observed, that the internal and external angles, and the upright divisions of the panelling, are usually simple lengths of stone as quoinings and fillings-in; the sinkings for the flint work appearing principally in the upper portions, or arched heads and other ramifications, of the tracery, where the elementary forms are more easily produced from the plain face of a block, than by the working and jointing of a number of smaller pieces,

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* The pannelled arrangement, here mentioned, is fully shewn in its application to the buttress, at the Divinity School, at Oxford. See view in the *Oxford Glossary, Plate* 24.

† Looking at the comparatively moderate cost at which the principle of this kind of ornamentation might be applied, it is, perhaps, worthy of consideration, whether the introduction of coloured tiles treated in the manner observed in many of these cases, might not be made subservient to very pleasurable effects and appropriate expression, if not in the exterior architecture, at all events in the interior of our churches, and such-like buildings. Under judicious treatment, decoration of the kind alluded to would be as effective, less expensive, and probably more lasting than cement inlays. There appears no reason why coloured or ornamented tile should be confined to pavements. The latter were originally merely imitations of mosaic decoration, anciently applied very indiscriminately.

which, in many cases, it would be, if not wholly impracticable, a work of infinite trouble to accommodate to the extreme richness and complication of the patterns, &c., employed. Very prevalent forms of the latter are traceried circles of every variety; with crowned, and other kinds of enriched lettering, extending in some to complete inscriptions. Southwold has the following invocation to the patron saint: "Sanctus Edmundus, ora pro nobis," in ornamented capital letters, above the hood mould of the great west window. At the east-end of Blythborough is a similar series of foliated letters formed in this kind of relievo of flint and stone. Shields and other heraldic insignia, with cyphers of various kinds, are common. The monogram of the holy name, and the crowned M. R., occur in numerous instances. Indeed, all the varieties of sculptured enrichment are to be found here elementarily represented.

But to return: *Plate* 9*b*, exhibits the flying arch, with the pinnacle and upper portion of the buttress from which the same springs, and the respond on the clerestory wall against which it abuts.

In *Fig.* 1, this is seen in side elevation, above a sectional line representing the aisle roof below it, with its parapet and gutter.

Fig. 2, represents, in front view, the parapet and the upper tabling of the buttress; with the aisle roof seen in elevation behind, and the pinnacle; the upper portion of which is here omitted for the purpose of shewing the lines of the capping of the flying arch in its rise to the clerestory respond, the connexion of which with the main structure is indicated, both here and on the section of the walling in *Fig.* 1.

Fig. 3, is the enlarged plan of the pinnacle, taken through its shaft at C. D.

Fig. 4, is a similarly enlarged section of the tracery in the spandril of the flying arch at E. F. The spandrel, as will be seen, is here solid. Very many are, however, pierced, of which very fine examples, as will recur at once to most of our readers, are to be seen in Henry VII.'s, Chapel at Westminster.

Fig. 5, is a section of the arch taken on the line A. B., or through what may be called its key-stone.

It will be observed from the joints of the flying arch, that it is constructed upon the ordinary arch principle, the same radiating to a common centre. Those of the capping moulding are perpendicular to the rake of the straight upper surface. The stones at either end, that is to say, at the respond and at the buttress, are bonded in the one case into the wall, and in the other into the buttress, forming portion of it; and upon the accuracy of position, and true arrangement of these stones, the efficiency of the action of the latter materially depends. This is particularly the case with that part which is constructed with and derives support from the buttress itself. This is the main butment, and the connexion should be such, that while the courses bond horizontally together, the thrust or pressure of the arch should be directed to, and thrown as vertically as possible upon the body of the buttress; the shaft and pinnacle being designed to act, for constructive purposes, as a superincumbent weight or resistance at the haunch of the arch. In some, this practical purpose is more clearly exhibited than in others. In the flying buttresses of Fotheringhay, North Hants, the springing-stone is placed just below the upper tabling of the buttress, from which the pinnacle rises simply as a terminating ornament. A less effective method of construction is, however,

apparent in many examples; and this is especially the case in the flying buttresses introduced rising from the pinnacles of a tower to a spire, of which an instance occurs at Caythorpe. As a rule the flying arch should derive its support quite independent of the pinnacle, which should be viewed as an accessory and subservient attachment. Two examples of the position and of the modes of placing the springer, anciently adopted, are shewn on *Plate 9b*; the one, *Fig* 6, being from Fotheringhay, above mentioned, the other, *Fig.* 7, from Westminster. In both of these the thrust is disposed upon the body of the buttress, the upper set-off or table of which rises above the parapet of the aisle.

In building the plainer and the more ordinary forms of the buttress, no particular constructive considerations present themselves. The work is for the most part usual wall work, the outer and inner angles of the projections, &c., of free stone, disposed alternately, each with a long and short return in reversed position, so as to break joint; and this is the case generally, whether the main bulk of the buttress is ashlar-faced, or formed, as is very commonly the case, of rubble, or random, or other coursed stone-work, of less free working nature. The buttress tables are, generally, each slope of one stone, but in works of large proportions the breadth of face frequently precludes this, and the same contain more than one piece in each course. The joints of these are of course perpendicular to the horizon, or at right angles to the beds, and it is of importance here, as in all other stonework, that the stone should be laid to bed as it does naturally in the quarry. A good tailing-in of the buttress slopes is also of some consequence constructively, as well as artistically speaking.

The same general principles regulate the proceedings in relation to the richer forms; in which, however, the workman has to employ a larger amount of ingenuity and labour, as respects the setting out and the execution of his work. It would be almost impossible to give, in a treatise such as this professes to be, particular directions as to modes of procedure, which must necessarily vary very considerably according to the nature of the design required to be executed. The various separations or jointings of the parts are usually, or should be so, shewn on the working drawings, furnished by the Architect; and it is principally to the economical or advantageous disposal of his material, and the question of facility as to time or operation, without prejudice to the proper turning out of his work, that the attention of the Mason is more directly called for. As a principle of universal application, as a greater or less assistant, the reference to given, or to be found, surfaces of operation as a basis, is indispensible. The more complicated arrangements of plan, and deposition of one part on another, cannot be well described in words without reference to a particular plan or object. For these the lines must be found, and produced from the plans and sections supplied, in a manner similar to that already referred to, when speaking on the subject and the methods employed in the stone-cutting of groins, &c. Most intelligent practical Masons will be competent to arrive at a satisfactory executive solution of the points which will in these cases evolve themselves, and have to be met. On this portion of the subject, therefore, it will be unnecessary to offer further or lengthened remark; and with the few general observations above given, the consideration of the various forms of tablings, strings, and corbellings, &c., and the usual arrangements of their construction may now be entered upon.

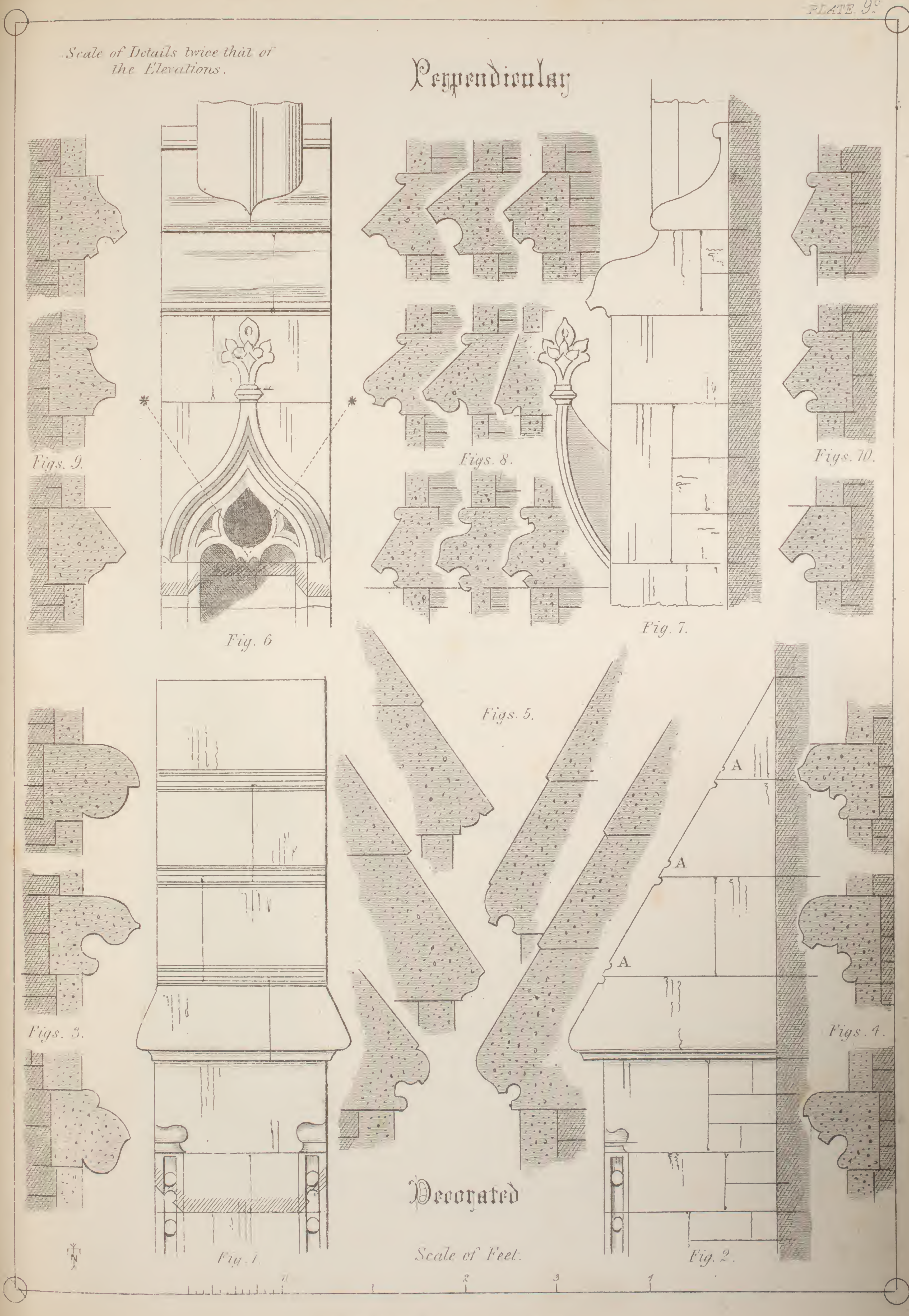
These, as connected features with buttresses just described, and with other projections formed by varying thicknesses in different parts, usually called sets-off, or by overhanging portions of walls, require, as respects their proper treatment and formation, a due attention on the part of the operative Mason. The character of them necessarily differs with the style of the several periods. The Norman tablings are, as before noticed, generally simple slopes, and the plinths are usually finished in the same manner. Occasionally series of mouldings are admitted, as York Choir (see *Fig.* 6, *Plate* 9). Strings at intermediate heights, as indicating difference of substance, are not very common. A plain string, says Rickman, is frequently used as a cornice, and a "square string is frequently continued," he says, "horizontally from one window to another, round the buttresses." The corbellings are not formed, as most usual in the after styles, by a series of mouldings, but in the case of parapets, where they nost frequently appear, generally consist of a range of blocks, or of carved grotesque heads, sometimes supporting a course of small hanging arches continued from buttress to buttress, and carrying the projection of the parapet, usually, as before remarked, in the same plane as the latter. Some of the varieties of the former will be more particularly adverted to and described, when treating hereafter on the subject of ornamental masonry. The latter it is hardly necessary to observe upon more fully than above done, since no particular or different constructive principle from that of other arched ornamentation is involved.

In the next, or Early English period, tablings, strings, and corbellings, are exhibited in considerable variety compared with the former. The buttress tablings of this date, particularly towards the end, are much more of a feature, and though retaining generally in these cases, the plain slope, simply multiplied to cover the greater projection, are occasionally found with a curved or moulded outline, as in the next succeeding style. The plinths usually finish, in the plainer and smaller examples, with the single plain slope. In the richer, as at Salisbury and other instances, a greater number occur. The Early English buttresses of the nave at Westminster Abbey have the sets-off of the plinth of a single slope above a bold ogee, and the tablings are of four and five slopes, rising at a very acute angle; a characteristic generally of this period.

In the strings of this style there is considerable variety. Sometimes they are composed of several mouldings, at others only of a round and hollow. The hood-mould of arches is also now frequently continued along the wall and round the buttresses as a string; and those at the foot of windows are some of them of very effective section. The string above the base mould C, in *Plate* 9, is a very good example of an Early English string. Some from St. Giles, Oxford, and Furness and Bolton Abbeys, are given in Rickman: there are also some very fine Early English strings at Pershore, Worcestershire.

In the case of projecting parapets after the fashion of those of the Norman age, a series of mouldings is now frequently introduced instead of the carved heads and brackets, and the same arrangement is followed in other overhanging projections. Where a parapet in the same plane as the wall occurs, a cornice is introduced, which is sometimes richly moulded. It most usually consists of a large hollow, with a round or hollow below, and an ogee or plain fillet above, at the point of an upper slope, which recedes to the wall. This hollow is generally

PLATE 9°



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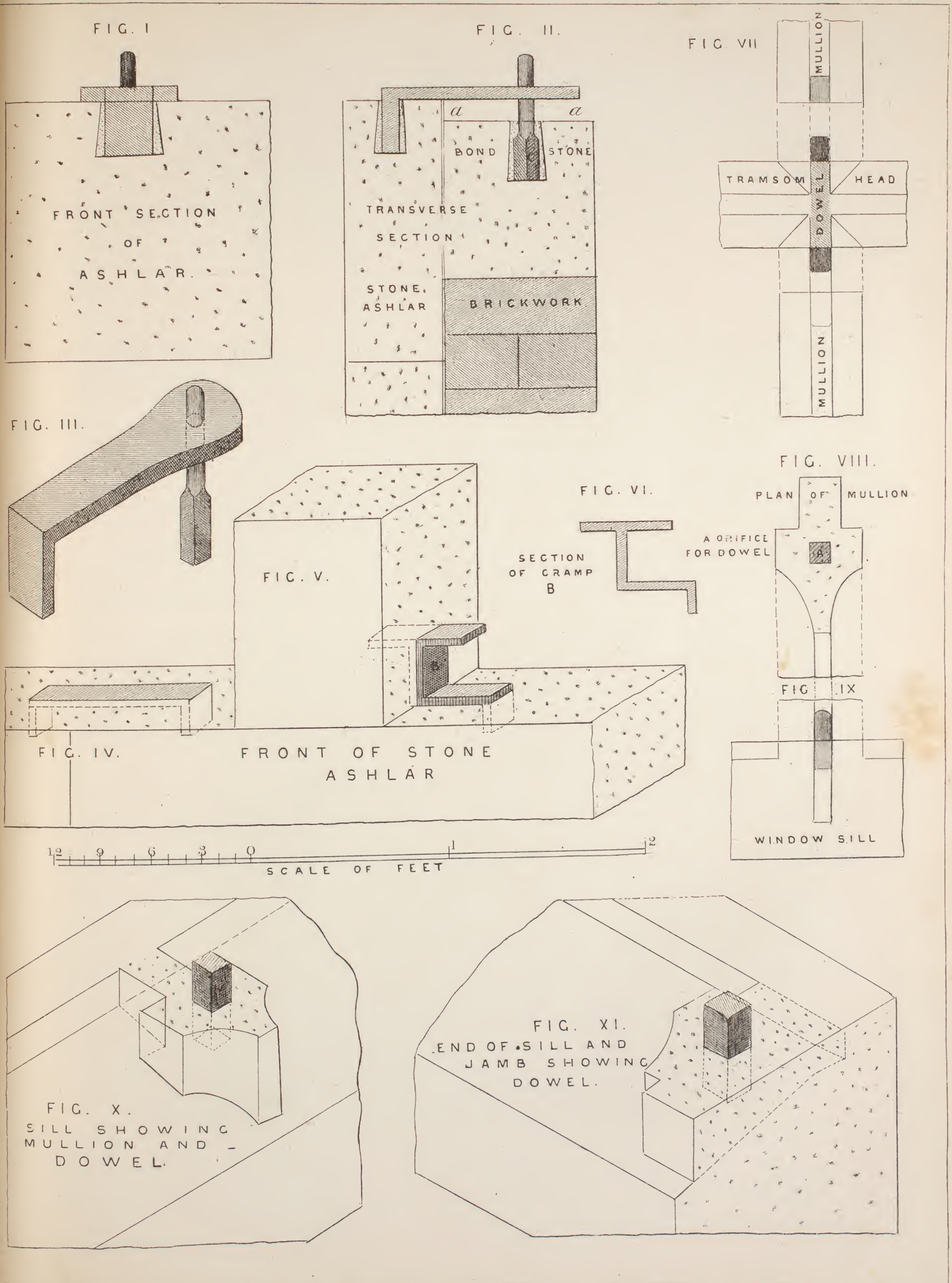

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churches of the eastern and north-eastern counties; the first, or upper, plain face being panelled, or otherwise ornamented, in dressed stone and flint. Another usual form is that given by Rickman, from Laughton-en-le-Morthen, Yorkshire, (*Fig.* 2). *Fig.* 3, from the old cloisters of St. Stephen, Westminster, and *Fig.* 4, from Covehithe Church, Suffolk, are likewise common forms.

There are several other varieties, for the most part composed of "reversed ogees and hollows variously disposed;" and in rich buildings, Rickman says, "several moldings and alternate faces are used."

The buttress tablings of this age, though more usually, as in the last, of several plain straight slopes, are frequently found of a curved section or outline, as is shewn in *Fig.* 7, *Plate* 9c. There are several examples in which this variation occurs; among the number, those of the buttress tablings of St. Lawrence, Evesham; and those of the south porch of Taunton, with many others.

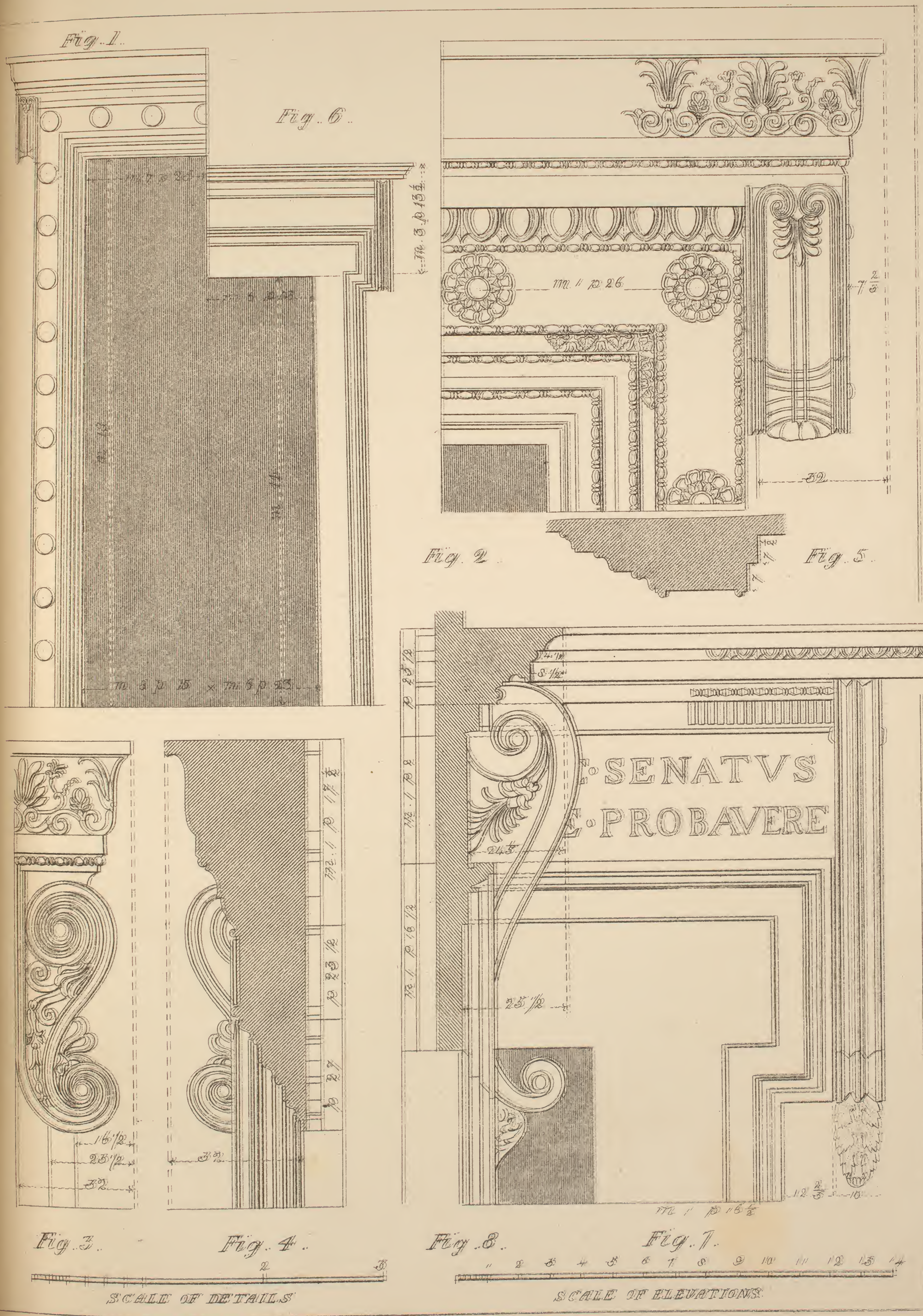
In domestic buildings the curved outline is also often observable. At Wingfield Manor-House, Derbyshire, the buttresses of the hall oriel have tablings of this kind. (See the *Plate.*) Those of the hall oriel of Crosby Place, London, are the same.

CHAPTER XI.

ON DOORS.

Doors, or more correctly speaking, doorways, are among the most conspicuous evidences of masonic skill and taste, and with reference to their proper treatment and arrangement as architectural features, have, from the earliest period, received a large amount of consideration. It has been observed, that "doors must have existed as early as human habitations;" and it is probable, that under the admission of any architectural pretension in a building, the door, as the the means of access to, and egress from it, would come in for its due share of attention. In the architecture of Egypt and other eastern nations, the doorways were usually highly enriched with sculptured and other ornament.

Among the Greeks, even in their temples or sacred architecture, this appears to have been less the case in the earlier instances than in succeeding and later examples. The early Greek doorways had, in many instances, only the plain unadorned ante-pagmenta or door-jamb and head, evidencing a reference to the timber type, which is more or less generally apparent throughout in their architecture; and in respect to this simple character, agreeing with the dictum of Vitruvius, who prescribes that "the profiles of the architraves and crowning members of doors should be conformable to the simplicity or elegance of the orders employed in the edifices of which they form a portion; following which he gives to the Doric door an ante-pagmenta or architrave composed of a simple band.



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Later examples exhibit an introduction of moldings upon the face and other parts of the architrave; and in the richer buildings an increase of these, and the addition of crowning or superimposed members upon the "superius" or transverse head. The doorway of the Temple of Minerva Polias, at Athens, is a fine example of the enriched ante-pagmenta, with a superimposed cornice and moldings; and that of the Temple of Hercules, at Cora, of a plainer kind, with an inscribed facia beneath the cornice. Both these examples shew the inclined jamb, by which the width of the doorway is made less at the top than at the bottom, and the latter has the superius or lintel continued on each side beyond the exterior line of the architrave, after a fashion very common in the Roman and Revived classic periods. In each case the cornice is supported by consoles. The other points in the treatment in these two cases will be seen on reference to *Plate* 10, in which *Fig.* 1 represents a general elevation of he first-named door, or that of Minerva Polias, with *Figs.* 2 and 3, a front and side elevation at large of part of the ante-pagmenta, with its cornice and console; and *Figs.* 4 and 5, sections through the same, also to an enlarged scale.

On the same Plate, in like manner, is represented—

Fig. 6, a general elevation of the door at Cora, with

Fig. 7, a portion of the upper part of the same to an increased scale, shewing the nature and character of the ornamentation more clearly, as in the case of *Figs.* 2 and 3; and

Fig. 8, a vertical section through the same, shewing the connexion of cornice and console, &c.

These two examples may be considered, to evidence in the one case, the richer descriptions of doorway, and the other, those which exhibit the simpler introductions of ornament in connexion with the otherwise original and plainer character of the more ancient specimens.

In the Roman era, great variety and richness is shewn in many instances. The door of the Pantheon at Rome is a good example of a Roman door of large size, and a curious one occurs at the Maison Carré, at Nismes. Among others, an example of a Roman door, which, following the fashion shewn in the Greek one before given from the Temple of Minerva Polias, has the diminished aperture, occurs in the Temple of Vesta at Tivoli, and several others might be mentioned as illustrating the practices adopted during this portion of the Classic period. Of many of these there are representations more or less perfect in Desgodetz, and in other works which treat of the architectural antiquities of the Eternal City; while in Palladio are given restored versions of the doors of the Temples of Nerva, Fortuna Virilis, and Vesta, &c., which may probably be considered as among the most noticeable and valuable of the Roman examples. Another well-known specimen is exhibited in the entrance to the Pantheon, given also in this latter author, as well as in other instances. This, as a doorway of very pure form and correct proportion, can hardly be enough studied, and for this reason it will be unnecessary, notwithstanding it has been before frequently illustrated, to refrain from a reproduction of its features, or consider the same uncalled for. Turning therefore to *Plate* 10*a*, it will be seen that *Fig.* 1, following the arrangement of the preceding plate of Greek examples, represents its general elevation to the extent of rather more than one-half, with portions of the enrichments and the subordinate arrangements for light, and the subdivision of its height, &c.

Fig. 2 is an enlarged elevation and a section of the upper part of the jamb, with the surmounting cornice and facia or frieze, and the superior and inferior portions of the columns which aid in the support of the transom.

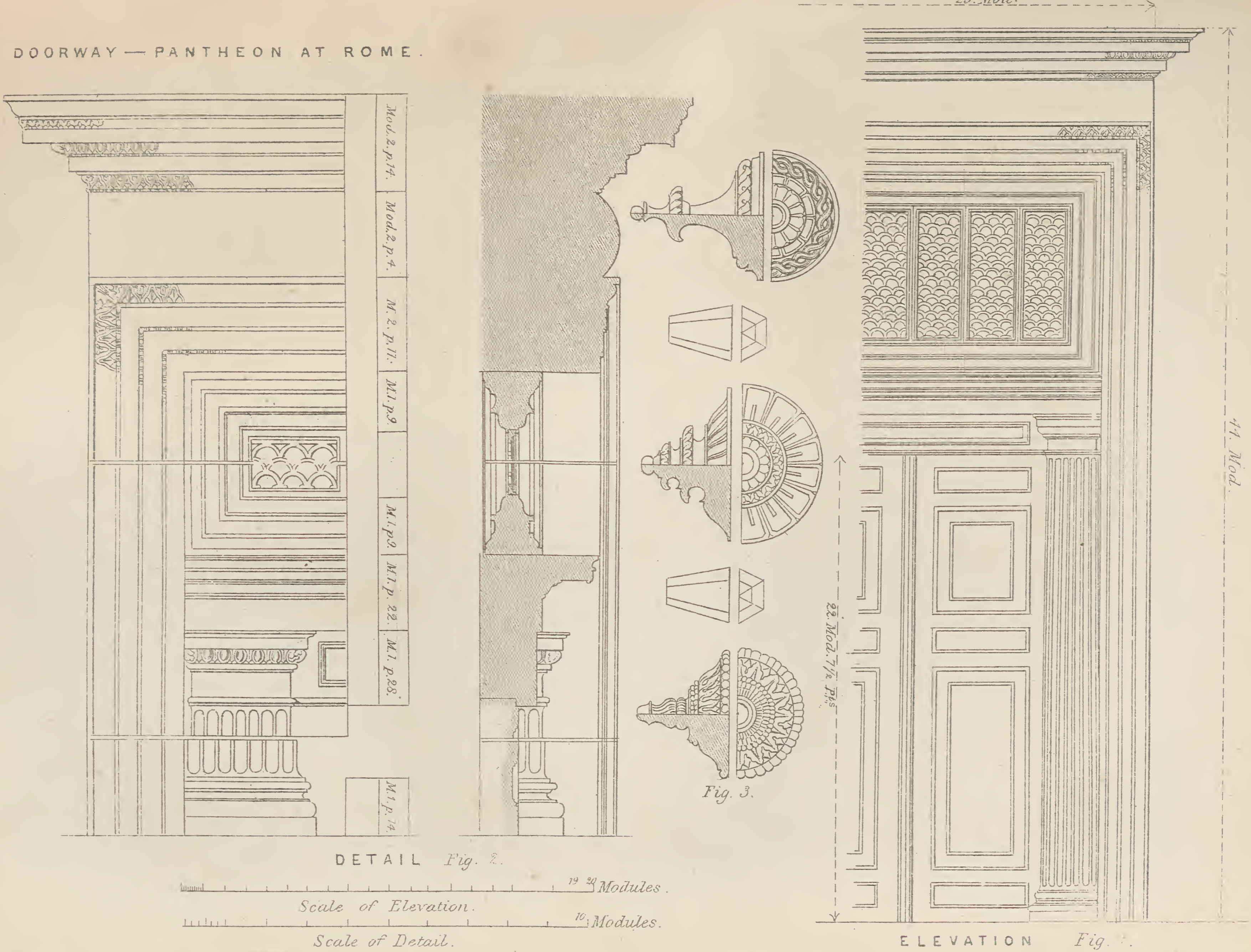
Fig. 3, shews the enlarged detail of the bosses and other ornaments on the stiles and rails and smaller panels of the door itself.

It will be observed that the door of the Pantheon shews a very simple treatment of the crowning members. There are no consoles or enrichments of this description, as in many other examples, though the general decorations of this building must have vied with any of them. Internally the circumference is described as divided into seven grand niches, worked in the thickness of the wall, before each of which are two fluted columns, each of a single block of antique yellow marble. As high as the grand cornice, the whole wall is cased with different kinds of valuable marble in compartments, and the frieze is entirely of porphyry. Between each of the niches in the attic, which forms the drum of the dome, and of which there are fourteen of an oblong form, are four marble pilasters, and between these, tablets of various kinds of marble. The exterior of the roof was covered, we are told, with plates of gilded bronze, and the walls were decorated with lead and brass, over which were carvings in silver. The tympanum of the superb portico, consisting of sixteen Corinthian columns of granite, octostyle in arrangement, behind which the door here illustrated stands, was adorned with bassi-relievi in brass, and the cross beams of the lacunaria or ceiling, as well as the original door themselves were covered with the same metal.

In the Temples of Nerva and Vesta at Rome, both, comparatively, equally rich examples, the doorways are also, according to Palladio, without the console, which appears, however, in most of the other Roman temples, as restored by him. To that of the temple of Fortuna Virilis, he gives a bold console; to that of Antoninus and Faustina one also, and to the doorway of the Roman temple called the Maison Carré, at Nismes, crowning members, all more or less enriched, and consoles of corresponding character.

In the Revived Classic or Italian period, the practice of thus enriching the doorway, particularly in the case of the exterior of buildings, was commonly followed, and we owe to it, as here applied, and also on windows, many very interesting varieties in their decorations. Previously, however, to entering into notices of these and the other peculiarities of the Modern Classic, as occasion will presently be taken to do, a few general observations in relation to the proportions usually observed in Classic doors may not be altogether without advantage in the practical consideration of the subject. Primarily, it has been remarked that the laws of nature and reason declare that the doors of a building should have reference, and be suited to, the human height, and under this view the door of an ordinary dwelling is usually constructed from 7 to 8 feet in height, and from 3 to 4 feet in width. Less restrictedly, and perhaps more properly considered, doors are, however, to be proportioned to the uses to which they are intended. The entrances to churches and public buildings should be of a width to allow of a number to pass without difficulty, and their height should be regulated proportionately, in accordance with the received canons in this respect. In the proportions of height to width, and

DOORWAY — PANTHEON AT ROME.



DETAIL Fig. 2.

ELEVATION Fig.

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vice versa, there is much variety among the ancients, and "from this" observes Ware, in his *Complete Body of Architecture,* "it was that Palladio evaded giving rules for the dimensions of doors in proportion to houses," being sensible "as it is continued," he could lay down none against which some instance might not be brought in those buildings which were allowed masterly in their kind." On this ground, it is stated, it is that he gives no rule, contenting himself by directing, "that they be proportioned to the dignity of the inhabitant of the house:" a theory which the authority quoted very properly takes occasion to dissent from, determining, "that be the condition or benevolence of the master what it will, the door ought to be proportioned to the other parts of the building." Another author, speaking of doors, says: "the style of decoration, and the proportion of doors which serve as entrances to public edifices, are naturally connected with that of the orders with which they are employed;" and referring to the rules for the same prescribed by Vitruvius, says, that though the latter are made mention of by him as peculiar to temples only, yet "their principle is founded on the harmony which the style of architecture, expressed in each order, ought to prescribe to the parts that enter into the composition, of which the order is the regulator." Acting upon this, he gives as the proper proportion of height—for a Doric doorway, twice and a sixth of its width; for the Ionic, twice and a fourth; and for the Corinthian, twice and a half; presuming that in each case the apertures are semicircular headed.

For doors with platbands or straight heads, he determines the proportion by dividing the width of the aperture into twelve parts; giving twenty-four for the Doric, twenty-five for the Ionic, and twenty-six for the Corinthian.

"This theory relative to the dimensions of doors, however," he judiciously observes, in concluding, "has, as may be easily discovered, no other object in view than to make the apertures of edifices partake of the measures assigned to the proper character of each other. Whence it results that similar measures are not geometrically fixed; as it is the judgment alone that is capable of making suitable applications, and determining the different relations that doors ought to bear with their intended situation." The latter part of this observation contains really the whole pith of the question. As a general rule, founded on the best examples, and on observation thus qualified, modern practice gives to the apertures of doors twice their width in height, apportioning to the breadth of the antepagmenta, or architrave, from one-fifth to one-sixth, and for the height of the superius, where a frieze and crowning moldings are introduced, from one-third to one-fourth for the distance between its soffit and the summit of the cymasium, or upper member of the cornice. The latter is, perhaps, the better proportion in the case of the addition of a pedimental termination above. For arriving at the proper proportion of the last-mentioned feature so applied, as well as otherwise made use of, several methods are to be found. That given by Vitruvius is, by dividing the whole length between the two extremities of the base line of the pediment, represented by the fillet of the corona, into nine equal parts, and taking one of these for the height of its tympanum, or enclosed space. This accords with the proportion exhibited in most of the Grecian and purer Roman examples. The two following are also methods: the first, resulting in a proportion of about two-ninths, and giving an angle of inclination of about twenty-two and a half degrees, is that

of Vignola; and the second, agreeing nearly with the Vitruvian proportion before mentioned, is from a French authority, referred to in Stuart's *Dictionary of Architecture*, Art. Pediments

From the point C, at the distance of half the length of the base line A B, let fall the perpendicular C F, and with the radius C B, describe an arc, cutting such perpendicular line at F. Then with the radius F, A, describe the arc A D B, the intersection of which with the line C F, produced upwards to D, will determine the height of the pediment.

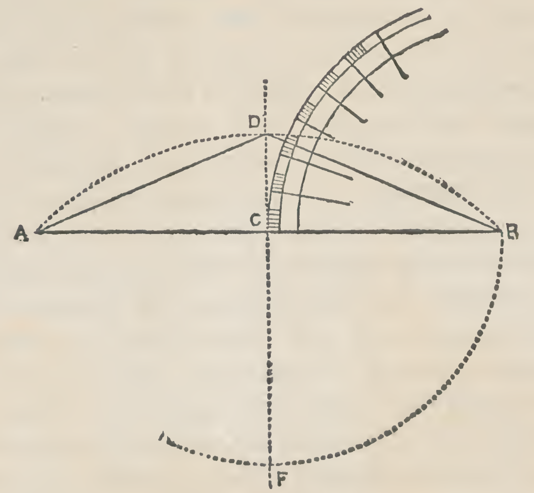


Fig. 1, from Vignola.

From the point A, the apex of an equilateral triangle, of which the base-line B, C, represents the fillet of the corona, with one side of the triangle as a radius, describe the arc D B E. Then from the point of intersection of this arc with the perpendicular A F, at at G, as a centre, and with the depth of the entablature as a radius, describe the smaller arc or portion of a circle H I; when a line drawn from the point B, or its opposite C, forming a tangent to the circle, will give the inclination or rake of the pediment.

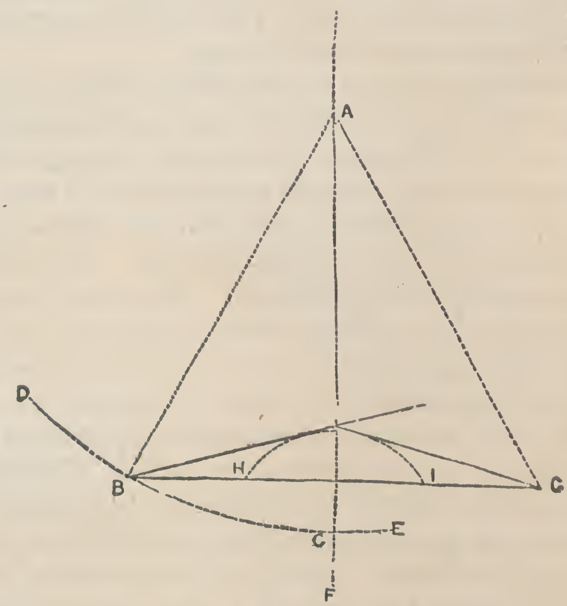
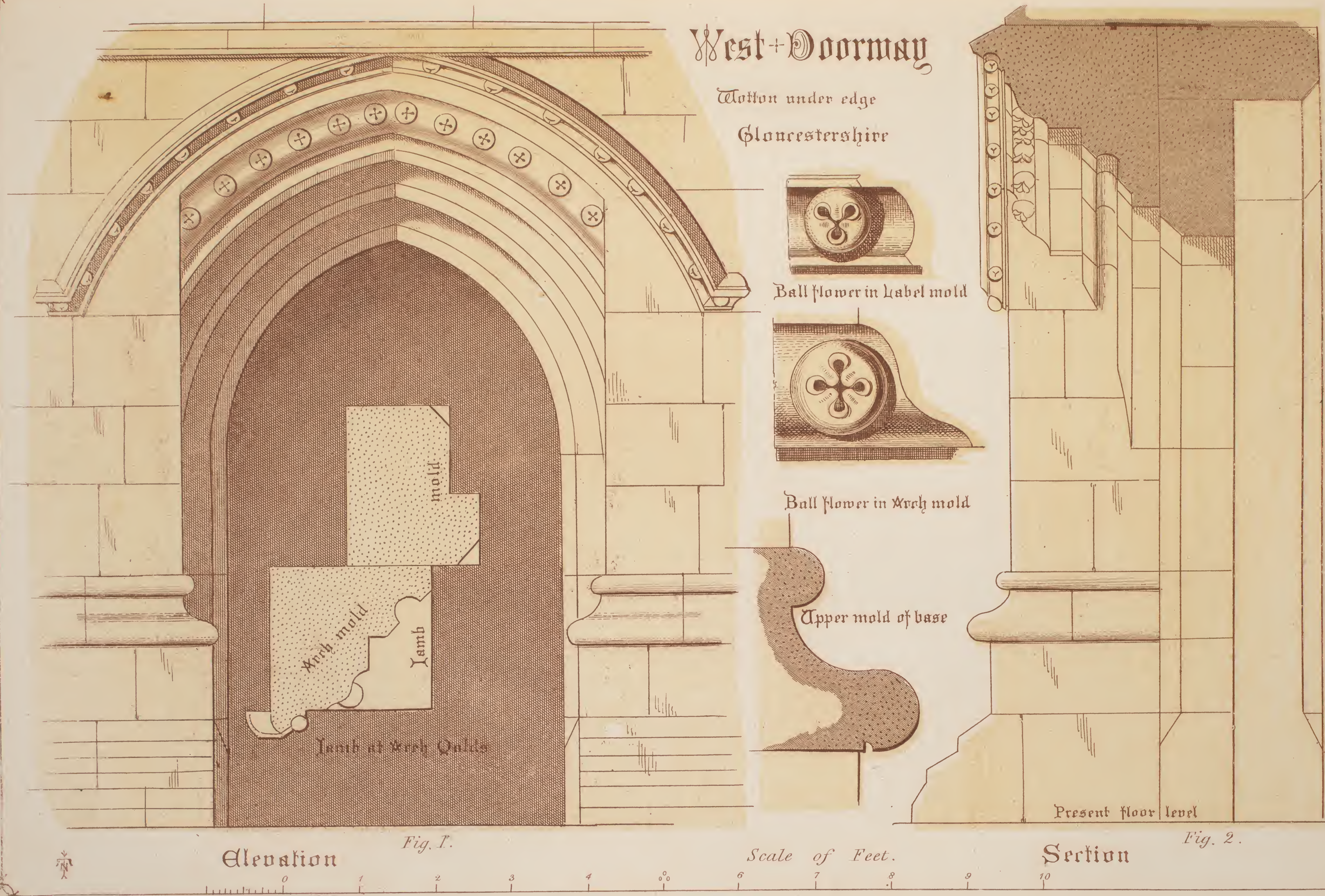


Fig. 2, from Stuart.

In the proportions for pediments, as here given or otherwise, however, as with the doors beneath them, and other features, there were frequently variations to a greater or less extent.



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On these points, and for much other information on the ancient pediments, the work of Slieglitz, "Archæologie des Baukunst," may be referred to with advantage, and for the like on pediments generally, the "Cours d'Architecture," of Blondel.

In the Mediæval doors the rules of Classic proportion were altogether disregarded. In these the variations of treatment are innumerable. The earlier in their general form partook of the later Classic or Roman type. The semi circular, or round-headed arch is characteristic of them, generally, down to the commencement of the 13th century. The later differ in the pointed forms employed, and in the recession usually, as contrasted with the projected arrangement of the moldings and other ornamentation applied in the former period. As a principle, the enrichment derived from molded work in the later mediæval period is sunk from the main, or general, surface in which the door is placed, contrary to the Classic practice, which superimposes, for the most part, the decorations of the doorway. This principle is developed, to a very large, if not the fullest extent, in some of the portals of French and German Churches; and it is more or less, and with greater or more restricted amount of richness, exhibited in all. The Byzantine and Norman doors, the latter especially, are a series of recessed planes, sometimes enriched with molded and other ornamentation, and sometimes plain, the angles being occupied by shafts, the capitals of which support the arched arrangement of the several faces. The Early English doors, says Rickman, have the recess "often as deep as the Norman; but the bands and shafts are more numerous, being smaller." "The dripstone," which is usually the only bolected molding, he continues, "is clearly marked and often small." "The principal molding has generally an equilateral arch, but from the depth and number of the moldings, the exterior becomes often nearly a semicircle." The shafts of this age, he says, have a variety of capitals, many plain, but many with delicate leaves, running up and curling round under the cap molding, often looking like Ionic volutes. The bases are also various, but a very prevalent one, "used not only to shafts, but sometimes as a base tablet, is curious from its likeness to the Grecian attic base." The "moldings are all cut with great boldness, and the hollows form fine dark shadows." A fine example of the Early English recessed door occurs at Lichfield, which is the more to the purport of the point of distinction referred to, "for its resemblance to those of the foreign cathedrals before adverted to." It is, like them, recessed in a porch formed in the thickness of the wall, the arch being richly ornamented, and the jambs enriched with statues, resting on corbels, and crowned with canopies. "The recess is groined, and the whole is worked with great delicacy, and is full of rich ornaments."

This is one of the richer examples of Early English doors, but in all the numerous others of a plainer kind which might be enumerated, the same principle of construction is followed, and this applies even to some of the smaller interior doors which have flat or straight heads. Here, likewise, the jamb moldings, when they appear, are similarly formed by recession from the face of the stone.

Of Decorated doors—without entering in particular description of the several varieties of disposition followed in the application of the same principle, since the Decorated arrangements differ but little from the preceding Early English,—it will be sufficient, as clearly evidencing it to refer the reader to *Plate* 11*a*. This represents a Decorated doorway from the church of

Wootton-under-Edge, in Gloucestershire, *Fig.* 1, being the geometrical elevation, with a horizontal section or plan of the arch and jamb mold, and,

Fig. 2, a vertical section through the centre; the smaller figures shewing the detail of the ball-flower enrichment in the molding of the arch and dripstone, and the upper mold of the base. The effect of this door is very good, and the treatment altogether is simple and inexpensive. The plain straight depth of the jamb, formed by the wall in projection of the plane in which the actual doorway stands, throws a bold, deep shadow, and gives the appearance of great depth and substantiality to the entrance. Many Decorated doors have, in a measure, the same character. "In small churches," says Rickman, speaking of Decorated doors, "there are often nearly plain doors, having only a dripstone and a round molding on the interior edge, and the rest of the wall a straight line or bold hollow, and in some instances a straight sloping side only." The doorway at Wootton-under-Edge, however, may be considered as alone, it is probable, in the extent or depth of this straight side.

In Perpendicular doorways, says the accurate, and almost universally-consulted authority just quoted, "the great distinction from those of the last style, is in the almost constant square head over the arch," and in the later periods a further one is the depressed form given to the latter. The earlier Perpendicular doors have the acutely-shaped arch, struck from two centres more or less closely placed on the same springing-line. Those of a later date are what is called four-centred, and are struck from centres of which two are on the line of springing, and the other two at a greater or less distance from the first. When treating on arches, in a former part of this work, this latter description of arch has been referred to; and illustrations of its form and mode of construction given. (See pages 31 to 35, and *Figs.* 1 and 4, in *Plates* 5 and 5*a*.)

On reference to these for the form of the arch, and for the square-headed hood-mold above it, just adverted to, with its connected ornamental spandrils, the operative mason will arrive at a clear idea of the prevailing characteristics and appearance of the later Perpendicular doors. Of course, there are admissions richer in the nature of the detail than here pourtrayed, but the latter, when apparent, are usually found simply imposed upon the general under forms here expressed.

Fig 4, *Plate 5a*, above mentioned, shews a treatment of a Perpendicular door-head, which has an appearance far from unpleasing. Rickman, so often before quoted, and from whom it is unnecessary to offer apology for quoting, since his observations and descriptions are at all times very valuable, says, in relation to the section of the jamb moldings of this period, "the architraves," particularly in small works, "have generally one or more large hollows, sometimes filled with statuary niches, but more often plain," and this, he adds, "is one of the best marks of this style." This is exhibited in the enlarged detail of the figure just mentioned, given in the woodcut at page 33, and there is a good and pleasingly-treated illustration of the peculiarity, in a door at Wimborne Minster, in Dorsetshire, where the outer molding, instead of the more usual round or segmental hollow, takes the shape of a sunk panel in the jamb, which, continuing round the square head, dies, as is commonly the case with the other moldings, on the splay of the plinth, the beads, which form the extreme and outer finish of the panel, crossing

SAN LORENZO IN DAMASO FROM VICNOLA.

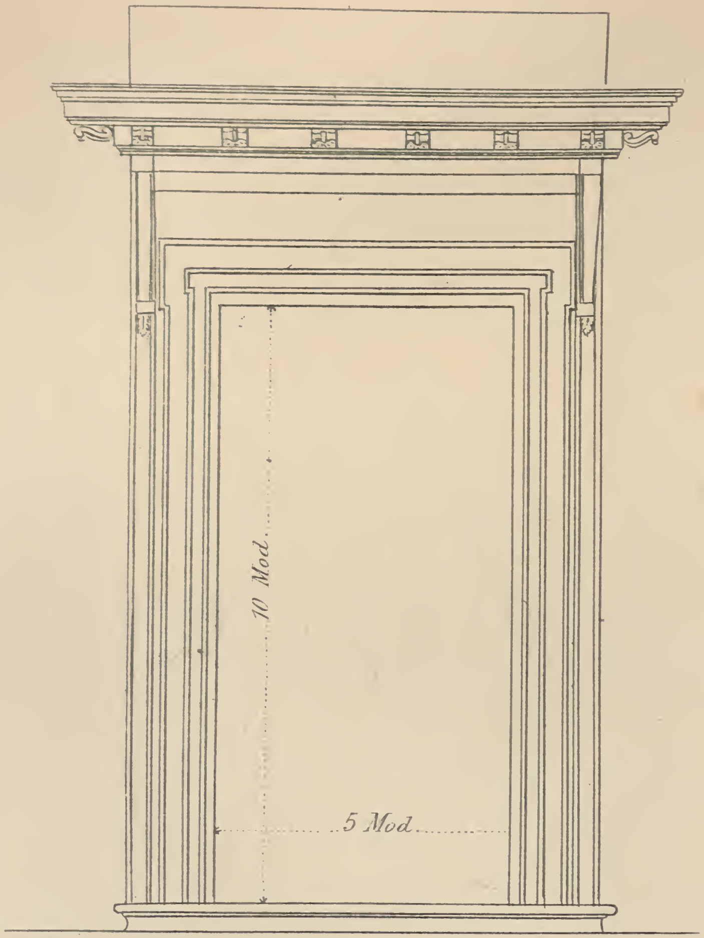
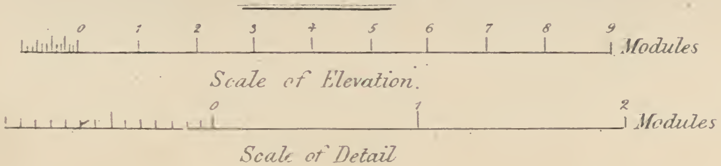


Fig. 1.

ELEVATION.



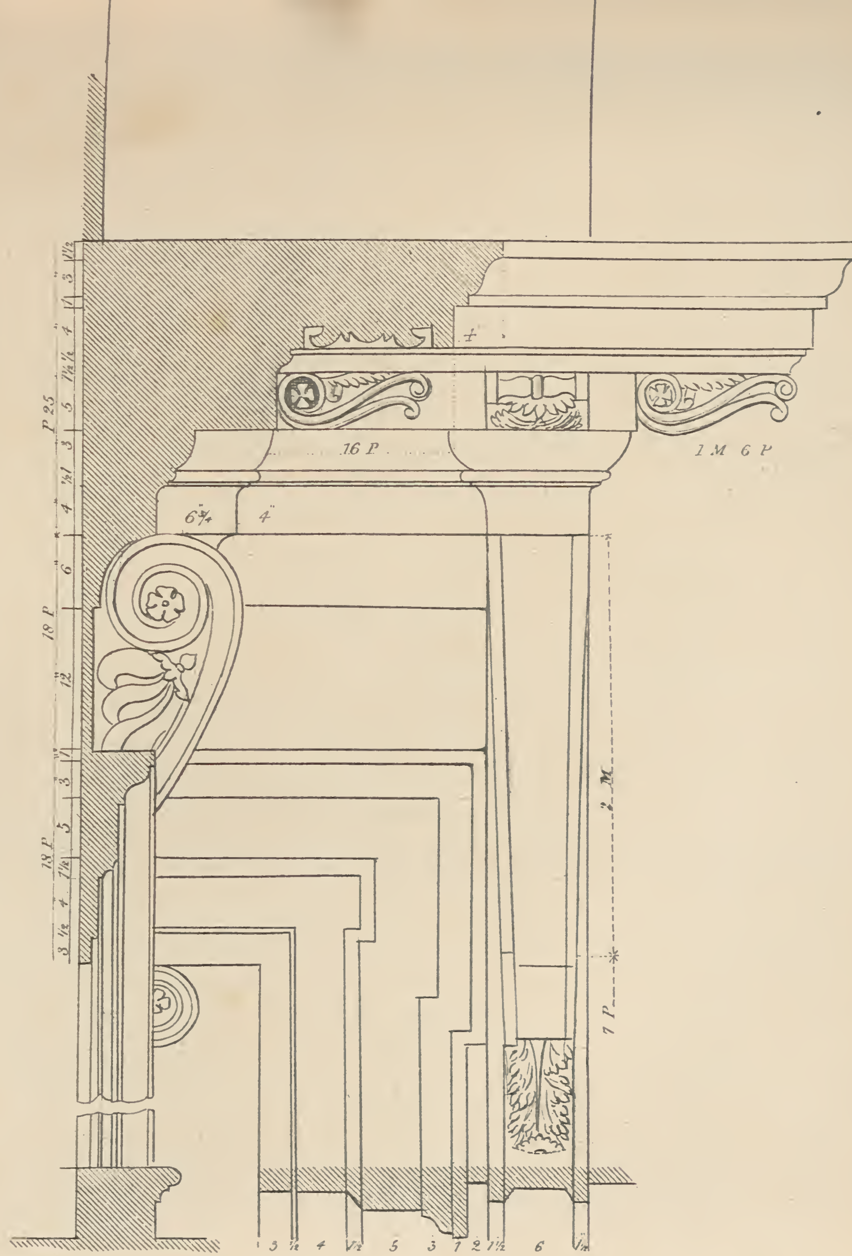


Fig. 2.

DETAIL.

DOORWAY — FARNESE PALACE AT ROME FROM VIGNOLA.

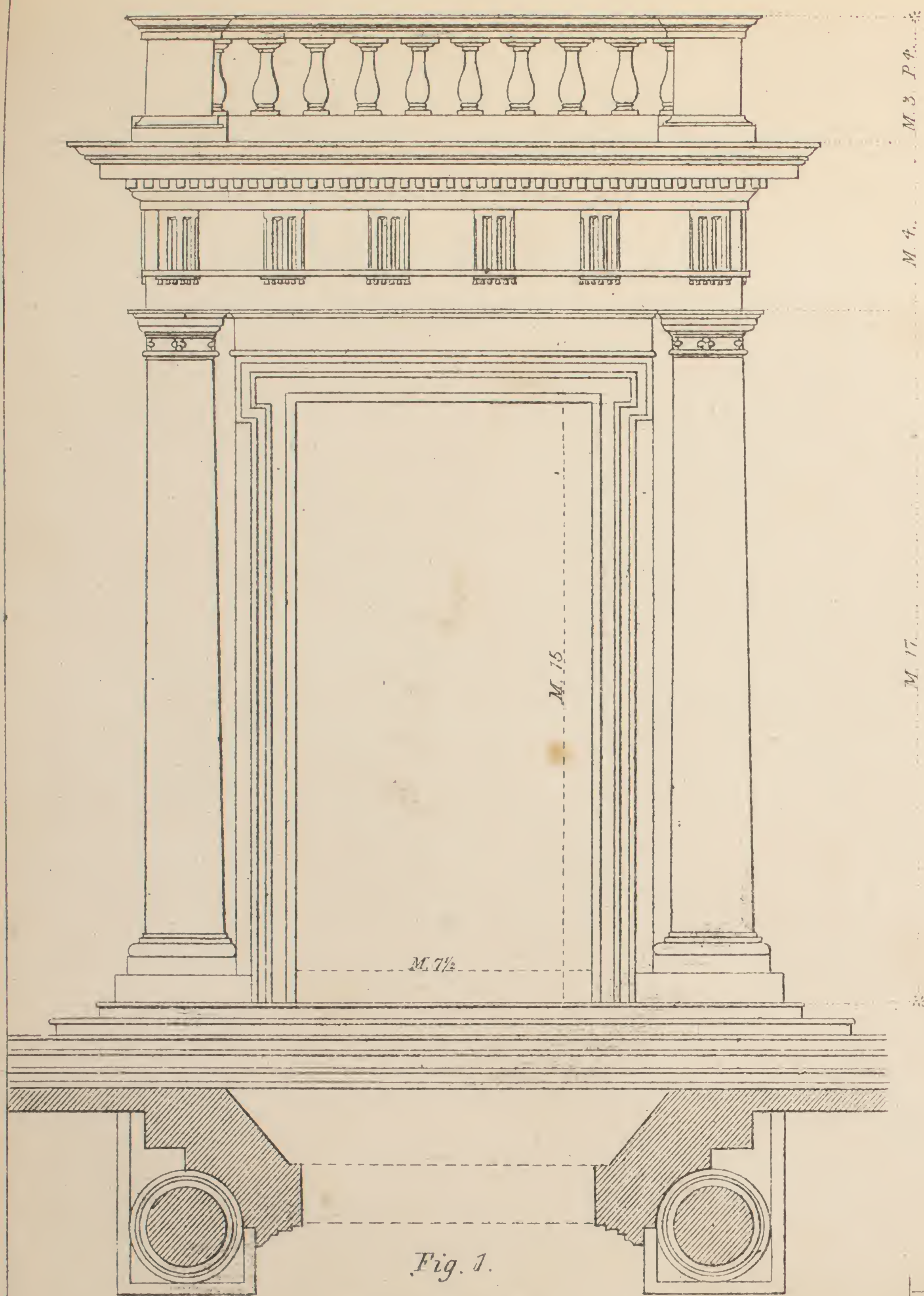


Fig. 1.

ELEVATION

Modules

Scale of Elevation.

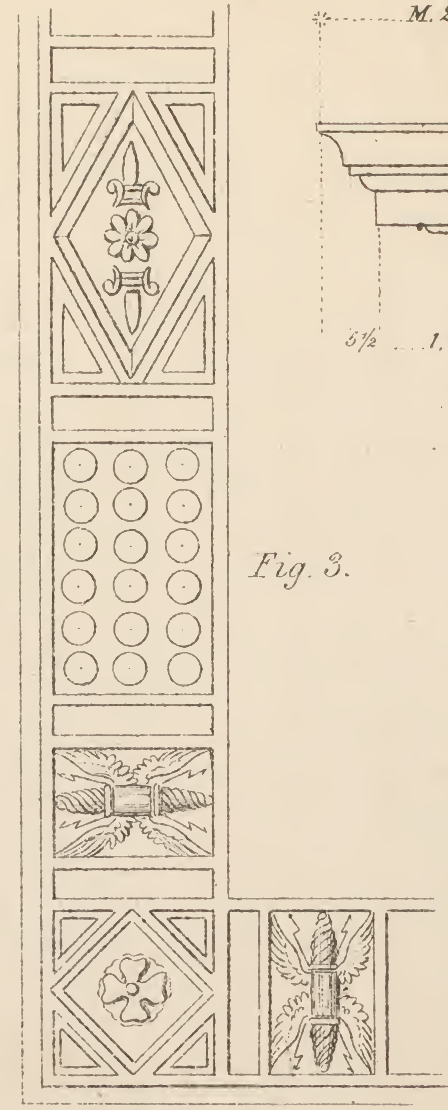


Fig. 3.

SOFFIT

Scale of Soffit.

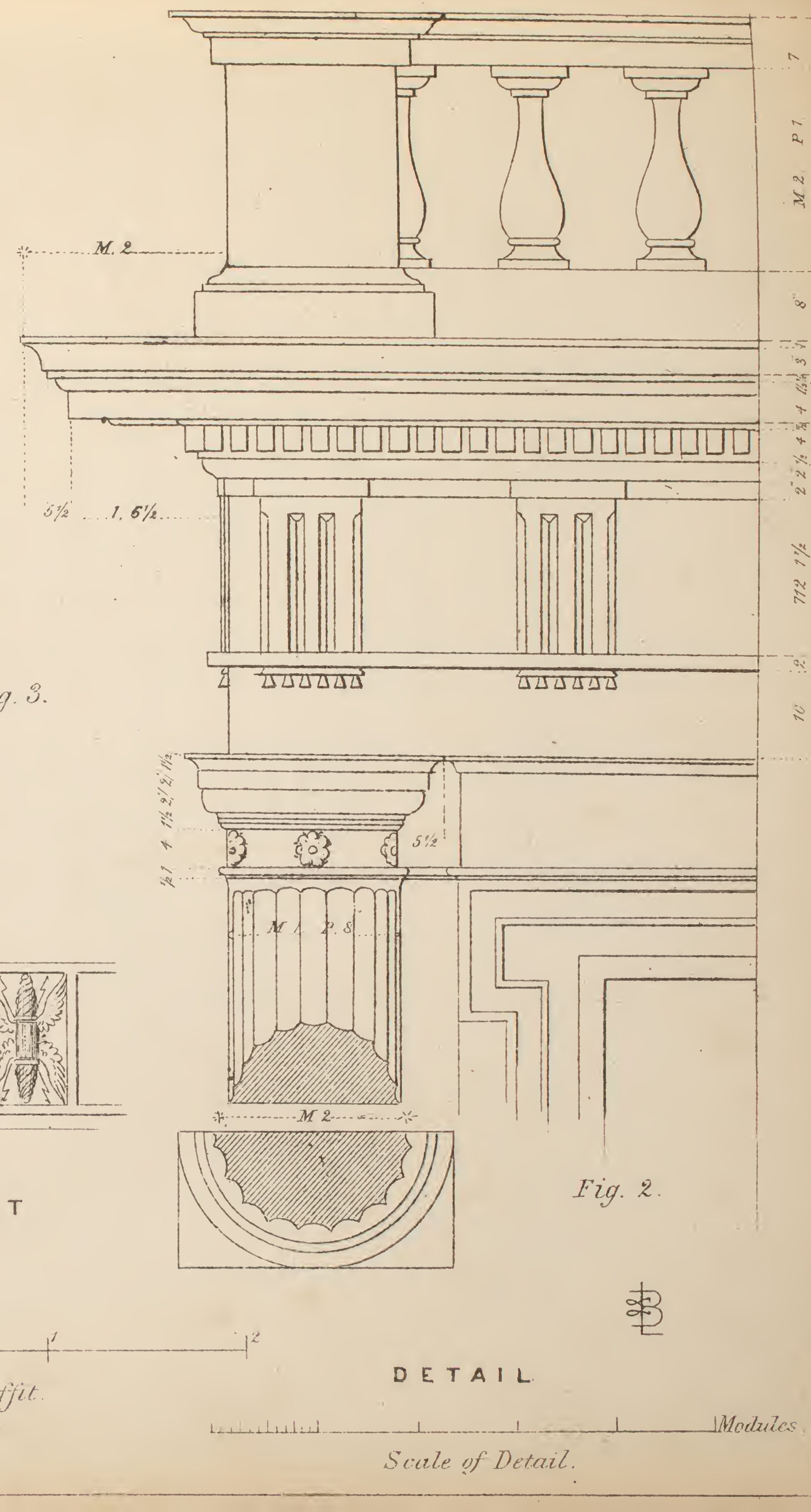


Fig. 2.

DETAIL.

Modules

Scale of Detail.

midway in the height and width and at the angles of the door jamb, and the fillet and hollow, which completes the molding of the same, forming a cuspated head or termination to each division. The effect of this and the contiguous ornamental spandril is very good. In this instance, the latter is an arrangement of three traceried circles within a larger general one. In some, other descriptions of ornament appear. At Southwold west doorway the spandrils have carved figures of flying dragons. In the porch to Westminster Hall, one of the heraldic cognizances of Richard II. is represented, and numerous other different varieties of ornament might be adduced.

The principles of design and construction contained in Gothic doors being included mainly in those of the several descriptions above remarked upon, a consideration of the revived Classic, and the kinds of modern doorways in general use may be next entered upon. The first, as revived in Italy, in the 15th century, and as exhibited in the works of Alberti, Bramante, and later, of Vignola, Scamozzi, Palladio, and other architects and authors of that school, profess to differ little from the ancient models, or chiefly only so far as was enforced by the limitations of a different material, and the altered state of manners and customs at the time. In principle and general treatment they are the Classic doors; the object of the revivers being a return to Classic modes of disposition and expression in the architectural requirements of the day.

It has been previously shown, what was the usual character and the appearance, in several instances, of ancient doorways,* and in *Plates* 11*b*, and 11*c*, are two similar examples of those of the period now under consideration. The first-mentioned is the door of the church of San Lorenzo, and the latter a door, described in the small edition of his "Ordini di Architettura," published at Milan, by the brothers Villardi, in 1810, as the Porta del Card. Farnese, both being the work of Barrozzi de Vignola, and at the same time well known and approved specimens.

For the particular and distinguishing features of these, it will be unnecessary to more than refer the reader to the plates above mentioned, in which it will be seen, that in each case, *Fig.* 1 shews a geometrical elevation of the doorway; *Fig.* 2, in *Plate* 11*b*, shewing a portion of the upper part of the same to an enlarged scale, with the principal measurements in parts of a module. In *Plate* 11*c*, *Fig.* 2, in like manner, gives an enlarged representation of the upper portion of the Farnese door, also with the proportions figured in the same way. *Fig.* 3, is the plan of the soffit of the Corona, shewing the guttæ or drops, the order employed in the decoration of the door being the denticulated doric, and the ornaments of its panelled portions. Beneath the elevation is the exterior plan of the doorway, and in connexion with *Fig.* 2, a plan of the upper and lower diameters of the column.

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* Further information on the subject may be obtained by consulting the works of Wood, Donaldson, Pococke, and others. The former author gives a description and representations of the door of the grea temple at Balbec, the lintel of which was upwards of 20 feet in length, and the height of the jambs 40 feet. Donaldson gives some interesting Grecian and Roman examples.

Into even the smallest division of the modern varieties or adaptations of the ancient and revived Classic forms for doors, it would be next to impossible, if it were in any degree necessary, to enter into description their name is legion; and all, therefore, that will be here attempted, will be the direction of the mason to a few examples and principles, which may act as a general reference and guide in the employment and execution of similar objects. The modern applications of the Greek may be passed with but slight observation. They are, for the most part, more or less copies of the Greek works made known during the period of the furor for the introduction of the temple architecture of the Greeks indiscriminately to church, mansion, and cottage; and thus disseminated, of one another. In the case of the church we have the Greek doorway of the Erectheum, one of the lordliest, copied at St. Pancras, and the list might be largely extended.

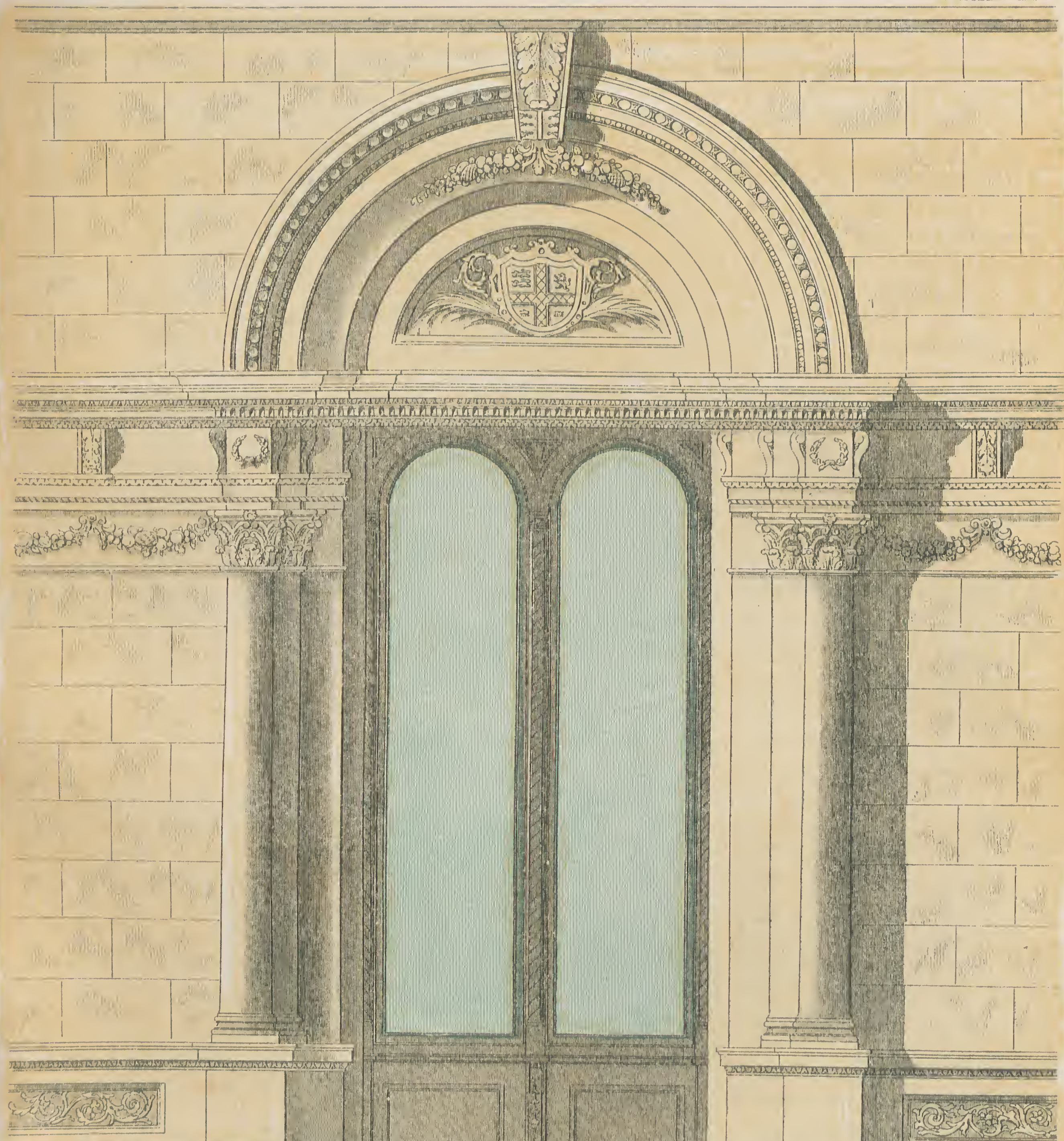
The modern Roman examples are more worthy of attention, and there are many among the works of Wren, (dec. 1723); his pupil Hawksmoor, (1736); Aldrich, (1710); Vanburgh, (1726); Gibbs, (1754); Burlington, (1730); Chambers, (1796); and others, that may be referred to with advantage for most, if not all, that is desired in dealing with Classic peculiarities and features, as applied to present wants. Of still later, including those of the present day, several other almost equally valuable and useful evidences are to be found As respects the feature under particular notice, there are some good doorways in several late erections in the City, as well as other parts of London. Some at the Bank of England, the Royal Exchange, with the Club-houses, at the West-end, may be especially mentioned, and there are one or two well-treated doorways in Victoria Street, Westminster. These are necessarily but a portion of what might be referred to in illustration of the practices of the present moment as regards the treatment of doorways according to the Classic style, but they will be sufficient, with the one or two examples given in the plates, to shew something of the variety which, by a judicious application of the old principles and parts, may be made available as occasion may now require.

In *Plate* 12, we have an entrance-door of a late, and rather ornate Roman character; the decoration being a composed order of semi, or attached, columns, &c., with a broken entablature, the cornice of which is carried through as a transom, surmounted by a semi-circular arched head, enclosing a sunk panel, enriched with sculpture. The outer molding or architrave of this arch is, as will be seen, enriched, and there is an ornamented key-stone, or console, from which a pendant scroll of fruit, &c., spreads itself upon the centre band or facia of the arch.

The cornice is denticulated to the extent of the width of the doorway, and the entablature is continued along the walls; having consoles and carved moldings, and the addition of a facia beneath, of the depth of the caps of columns, enriched with festoons of fruit and flowers. The columns stand on a pedestal, which is continued as a dado to the door-jamb, and along the wall, upon a rusticated base or plinth, the die of it, in the latter case, having panels, filled with a scroll ornament. Six steps form the ascent to the door, the face of the retaining walls of which are ornamented with lions' head in relief. The door itself is a glazed door, in two semi-circular-headed panels, and is hung to fold; the styles and rails being ornamented in a

A HALL ENTRANCE.

PLATE 12.



S. H. Brooke del.

SCALE OF FEET

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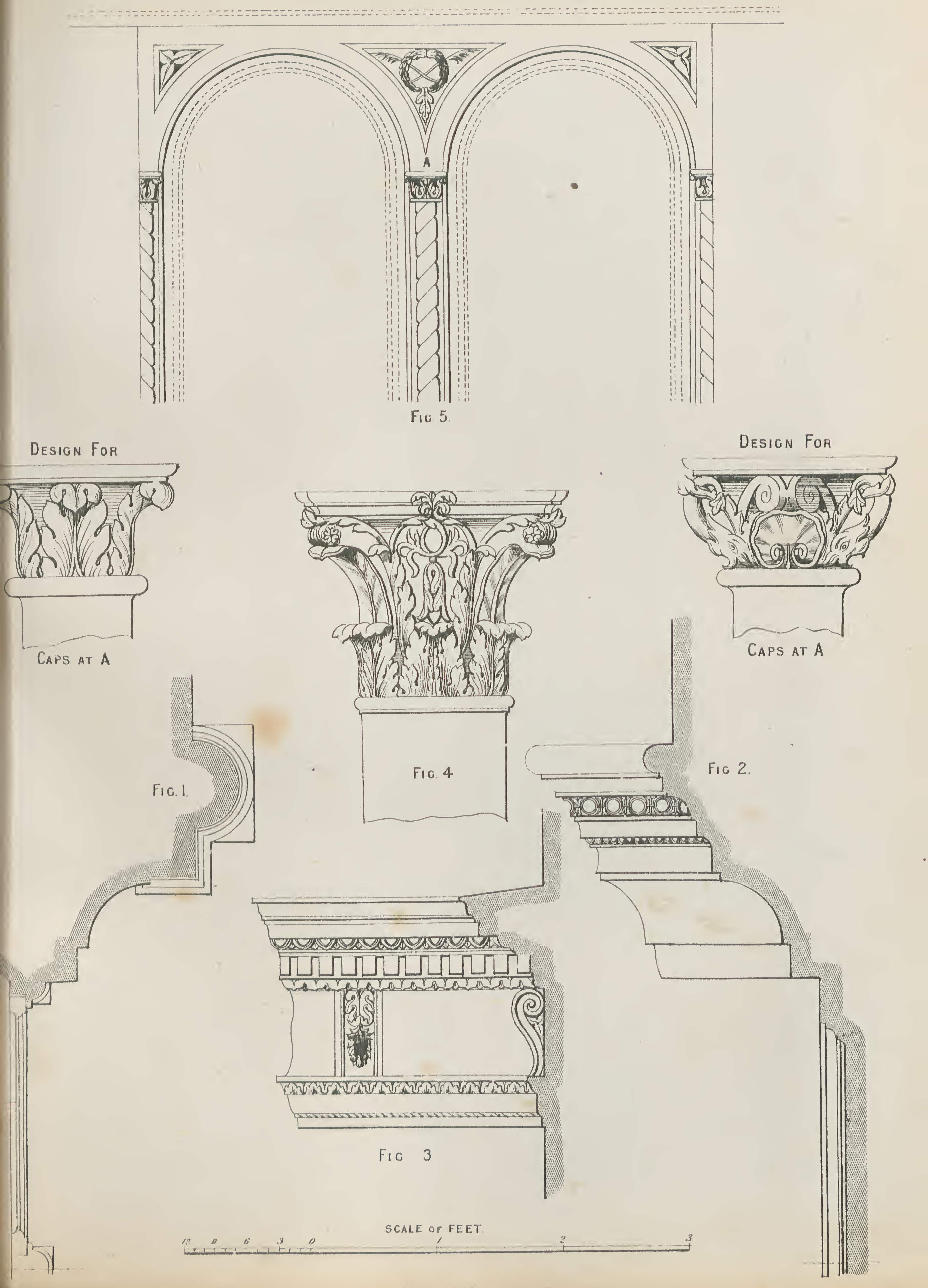
DETAILS OF ENTRANCE DOOR.
PLATE 12.



DESIGN FOR A DOORWAY.—ITALIAN STYLE.

FIG II

FIG I ELEVATION

FIG III

1 2 6 1 2 3 4 5

SCALE TO DETAILS

FIG IV

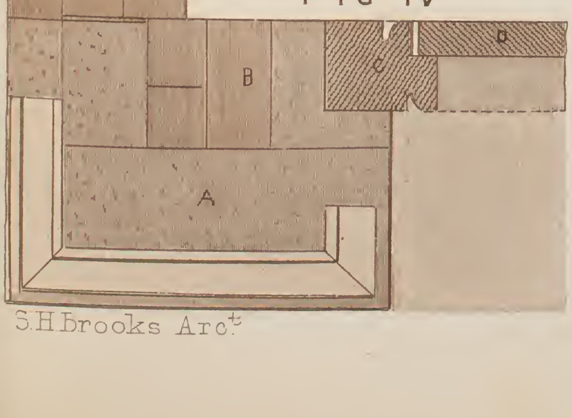


FIG V

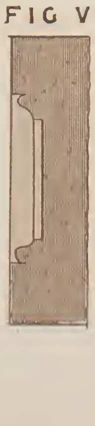


FIG VI

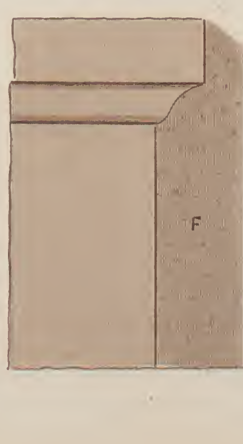
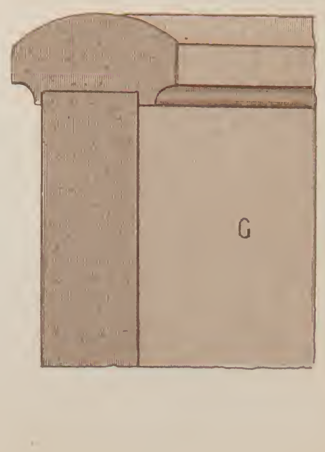


FIG VII



S.H.Brooks Arcᵗˢ

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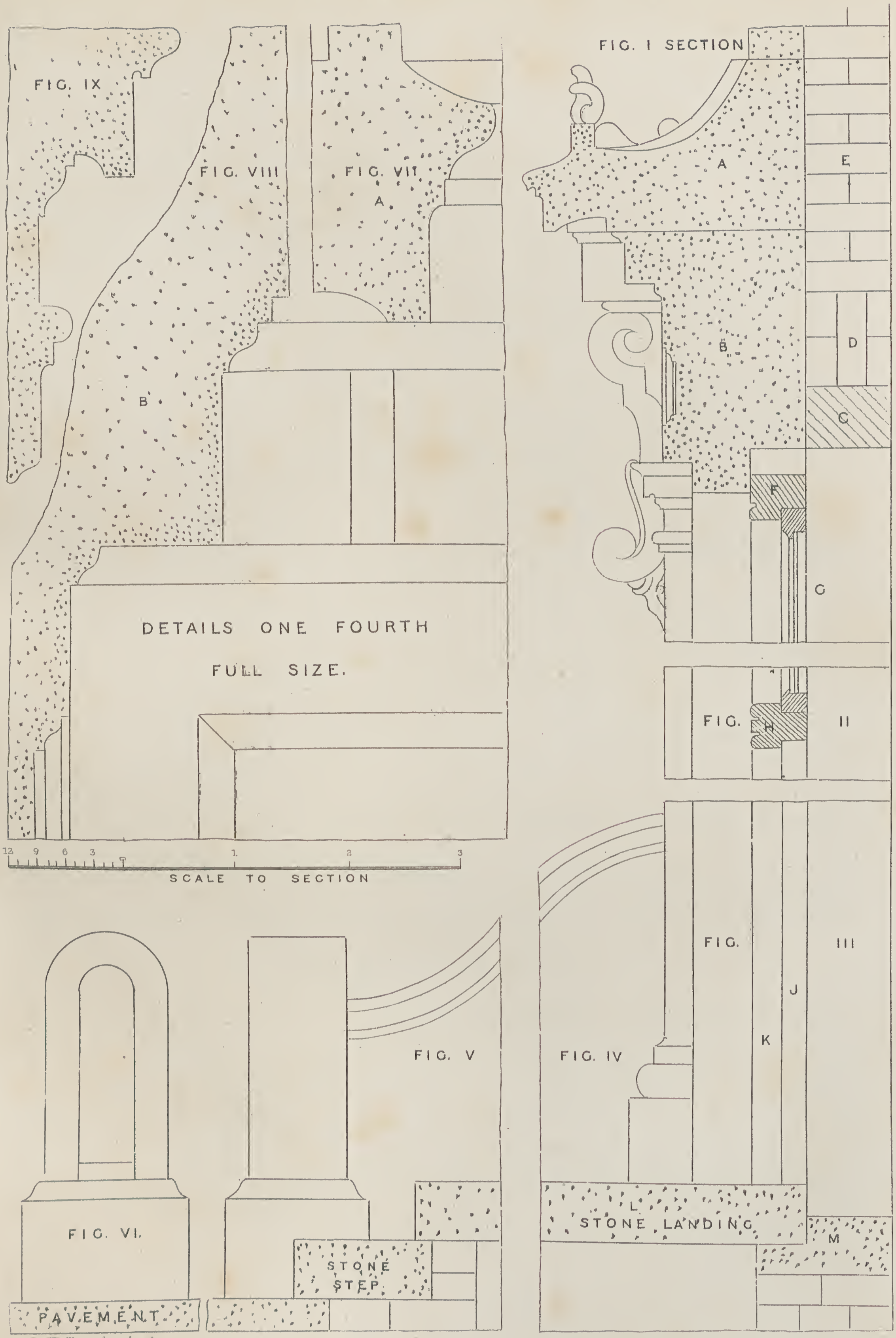
SECTION AND DETAILS TO PLATE 14.



C H Brooks, Arct

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character to correspond with the stone portion. This door would be suitable and appropriately placed at the garden front of a mansion.

Plate 13, gives the detail of its parts.

Fig. 1, is the half plan, taken below the caps of the columns and above the middle rail of the glazed door.

Fig. 2, is a half plan, taken through the arched head above the entablature, shewing the recession of the several planes at this level, and the enrichments of the architrave to a larger scale.

Fig. 3, is an elevation of a portion of the entablature, shewing its ornamentation at large, with a vertical section through the same. The denticulated enrichment of the corona is here shewn, as continued in that part which runs along the wall. In the elevation of the door in *Plate* 12, the corona is shewn plain, or uncut into dentils.

Fig. 4, gives an elevation of the caps of the columns, and of the first returned plane, or pilaster, in connexion with the same.

Fig. 5, shews in elevation a portion of the door, with its ornamentation enlarged. The figures distinguished as caps at A being two varieties of design for the same.

In *Plate* 14, we have another form of doorway, on the Classic principle, after the fashion usually denominated the Modern Italian. The construction is assumed in the plate to be of stone, backed with brick, but it might be formed wholly in brick, coated with any of the established cements, and thus finished would be very generally applicable.

Fig. 1, is a perspective view of the entrance, with its door and fanlight over.

Fig. 2, is a portion of the geometrical elevation to an enlarged scale, shewing the consoles and cornice, and the cap and base, &c., of the pilaster.

Fig. 3, is a like portion of the side elevation, or profile.

Fig. 4, a portion of the plan, shewing, A, the stone ashlering; B, the backing of brick work; C, the door-frame; and D, the door.

Fig. 5, is a vertical section through the frieze at E, on the perspective view.

Fig. 6, the plinth of the stone pedestal or termination of the spandril walls of the steps marked F, and

Fig. 7, a section, &c., through the capping of the latter, at C.

In *Plate* 15, are further details, shewing—

Fig. 1, a section taken through the centre of the doorway at C, drawn to the same scale as the details given on *Plate* 14; A, being the stone cornice; B, the frieze; C, the wood lintel of the interior opening; D, the discharging arch over the latter; E, the brick backing or construction of the walling behind the ashlering; F, the head of the door frame; G, the fanlight sash; and H, *Fig.* 2, the transom rail.

Fig. 3, shews the lower portion of the door jamb; J, indicating the door; K, the jamb of the door frame; L, the stone landing of the doorway; and M, the paving of the hall, sunk for the reception of the door mat.

Figs. 4 and 5, represent portions of the spandrel wall, with the pedestal and steps, and

Fig. 6, the front elevation of the pedestal.

Fig. 7, gives the molding of the cornice A in *Fig.* 1.

Fig. 8, the bed mold, dentil-band, and frieze; B, in *Fig.* 1, and

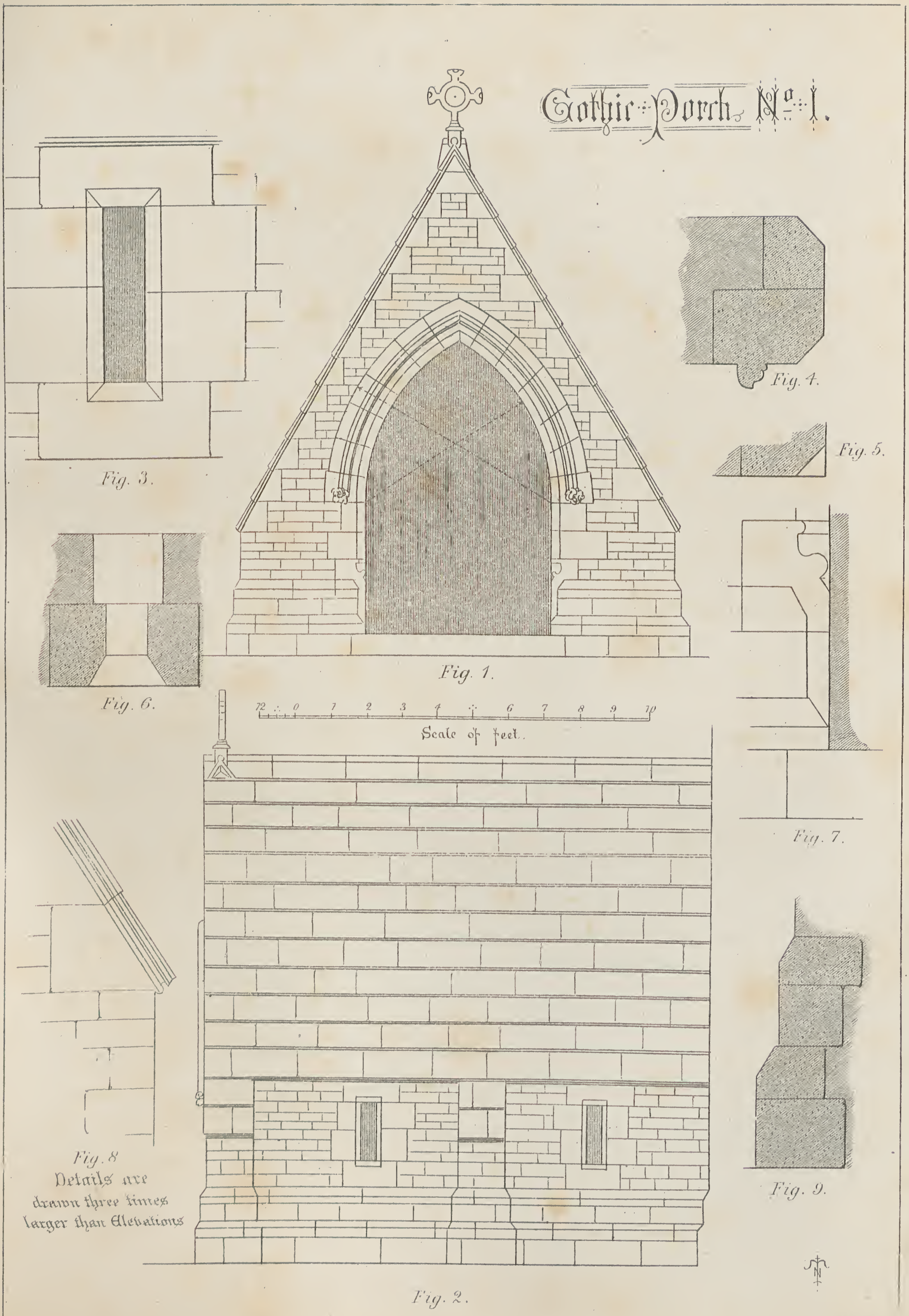
Fig. 9, the cap and astragal, or necking, of the pilasters.

The scale of the last three figures is, one fourth the full size.

In connexion with the exterior doorway of buildings, it is frequently now the practice to attach a covered projection, sometimes partially enclosed, and at others open on the front and sides. To these features the term porch is usually applied, derived from the latin "porticus," which, however, would appear to have had a more extended signification and application anciently. In the Classic ages, and in the sunny climes of Greece and Italy, the porticus took the form, more properly and distinctively than with us, of the peristyle or range of columns observed on the sides and at the ends of the Greek and Roman temples, and round the atria or enclosed courts of their houses, and doubtless here served the purposes of shade or protection from the sun, rather than those of shelter from the inconveniences attendant upon the less congenial climate, and more stormy weather of this country. From the paucity of perfect remains of the private dwellings of the Greeks and Romans, we are unable to learn exactly, the extent to which the porticus may have approached, in particular cases, the form and character usually given to this attachment to our entrances at the present day. In one building, that, of the Tower of the Winds, erected by Andronicus Cyrrhestes, at Athens, the entrance exhibits, according at least to the restored representations of it by Stuart and Revett, and others, a pedimented porch, with columns and pilasters agreeing in all respects with the general form and appearance of many of those of modern times. It has a projection of about two-thirds of its breadth, and is shewn as elevated on three steps, with a regular entablature and pediment. It is situated on the north-east face, covering the door of entrance to the building.

It is probable that this is about the best, if not the only example, that can be adduced as authority for the like Classic introductions, if such were necessary to establish the propriety of them, or required further than for the purpose of shewing the mode in which the feature was in this instance of its ancient adoption employed. In this country, the porch is in many, if not in most situations and circumstances, essential to comfortable use and occupancy, and this has always been felt and admitted. The porch is a distinguishing feature, both in ecclesiastical and domestic architecture throughout Northern Europe, during the whole of the mediæval period, and it has been continued, modified to suit the varying architectural characteristics of each particular and succeeding portion of the time, down to our own day; asserting still its claims to be considered as a useful and necessary adjunct.

The Gothic porches, or those of the middle age, were, in the case of the smaller churches, usually attached to the north and south doors, as the more common points of access. To the north they were especially prevalent, and were here generally of stone, as the superior and more substantial material, while the south porch was frequently erected in timber. In both cases, however, the stone porch was common, and particularly in the more considerable edifices. In France the porches are often of very grand proportion and elaborate structure, and at the same time very general. In domestic erections of any pretension or consequence



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it was also a feature almost universal, and, from its prevalence, and the architectural prominence and consideration given to this appendage, the "Porch House" was a frequent term employed. Innumerable instances might be cited in which it is found admitted, and from a very early to the latest period. More commonly in the former, the porch takes the character simply of a shelter for the doorway, and is limited to this, being roofed in above the outer arch of the doorway. This is the form it takes in most examples in the case of churches, though there are some early exceptions. Norman porches with an upper story occur at Southwell Minster, Notts, and at Sherborne, Dorsetshire, and the church of St. Cross, Hants, has an Early English north porch, with a chamber or story above. The same limitation as to height also applies in the majority of domestic instances until comparatively later times, when the porch appears to have consisted of more than one story in elevation. In several of the later churches, the porch has a chamber over it, which appears to have been very variously used and appropriated; and, in the case of domestic buildings, the same have sometimes one and sometimes more than one floor above the ground, or that at the level of the entrance. The porch of Wingfield Manor-house, Derbyshire, has a story containing a chamber over the entrance below; differing from those at Eltham, Croydon, and Cowdray, and many others, which were of one, or a ground story only. That of Porchester Castle-hall was the whole height of the building, having a room above the entrance to the Hall, which was elevated on a basement story, and was reached by a flight of steps occupying the lower story of the porch. In the Porch-tower of Dartington Manor-house, Derbyshire, and at East Barsham, in Norfolk, there are two stories above the entrance, and in similar erections this is frequently observed. Thorpland Hall, Norfolk, and Eastbury House, Essex, among many others, are examples of this description.

In many of these porches the roofs were formed, both interiorly and exteriorly, entirely in stone. The south porch of a church near Evesham, Worcestershire, and of Felkirk church, Yorkshire,* have very interesting stone roofs, of a similar formation to that given in *Plates* 16 and 16*a*, and others exist in the churches of Strelly, in Nottinghamshire; All Saints, Stamford; and Arundel, in Sussex. Of the internal stone roof, groined, in domestic buildings, a very elaborate specimen remains in the porch at Cowdray,† and some others might be mentioned, particularly during the later periods.

The porch at Felkirk is, apparently, of Early English or Early Decorated date, and is wholly built of stone; the roof being a simple arched vault, supported on stone ribs one foot in breadth, by ten inches in depth, plain chamfered at the angles, and springing from a string or impost, placed at about four feet from the floor. These ribs, in the same manner as is shown in *Plate* 16*a*, carry the stone ceiling or roof of the porch; ‡ the only difference in the

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* The sacristy of this church has also a vaulted stone roof.

† The plan of the groined roof of this porch may be seen on reference to the woodcut given in page 61, *Fig.* 1, in illustration of the subject of groining.

‡ The stone rib occurs, in some instances, as a support to a timber roof, in the larger erections, or under extended span. The modern roof of the Hall in the Old Palace of the Archbishop of Canterbury, at Mayfield, in Sussex, was supported on stone ribs or principals, spanning the width from wall to wall.

mode of construction being that at Felkirk, the courses of the stones of the outer covering are laid to bed horizontally. Those in *Plate* 16*a*, are shown as laid at right angles to the pitch, or raking like of the roof. There is also the slight further difference, that at Felkirk the upper part of the roof at the apex is worked in the solid, while in *Plate* 16*a*, it is shown hollow; the stones forming the outer shell being rebated together at the joints, after the fashion previously noticed at page 79. The general character and principles of construction adopted in both these porches will be fully apparent on examination of *Plates* 16 and 16*a* That at Felkirk is simply the plainer form of the two, as well as the smaller, and it is without the side windows shown in the others. The various points of this will be seen on referring to the plates, in the first of which, *Plate* 16*a*—

Fig. 1, gives a geometrical elevation of the front, with its gable cross and other decorative and constructive features.

Fig. 2, is a like geometric elevation of one side; showingits buttresses and the two small windows for light.

Fig. 3, shows one of these same windows to a larger scale; *Fig*. 6, being its plan.

Fig. 4, is a section of the arch-mold and its label.

Figs. 5 and 7, the jamb-splay and its stop-chamfered termination, with the mitred return of the plinth or base mold.

Fig. 8, shows an elevation of the springing stone and molded coping, or weathering, of the gable, and

Fig. 9, is a vertical section of the plinth, which, as will be seen in the side elevation, is continued and mitred round the buttresses.

In *Plate* 16*a*—

Fig. 1, is a transverse section of the porch, shewing the radiating lines of the ribs and of the arch-stones of the inner, or church door, and the direction and form of the beds or joints of the roof stones. It will be observed that the ridge course is solid, and that cramps are introduced at the base of the void in the upper part of the roof, as they are also to connect the stones above the ribs, shown in *Figs*. 2 and 5.

Fig. 2, is a longitudinal section through the centre, showing the interior elevation of one side, with its windows and the stone seat attached to the wall.

Fig. 3, is an enlarged elevation of the upper portion of one of these windows, and

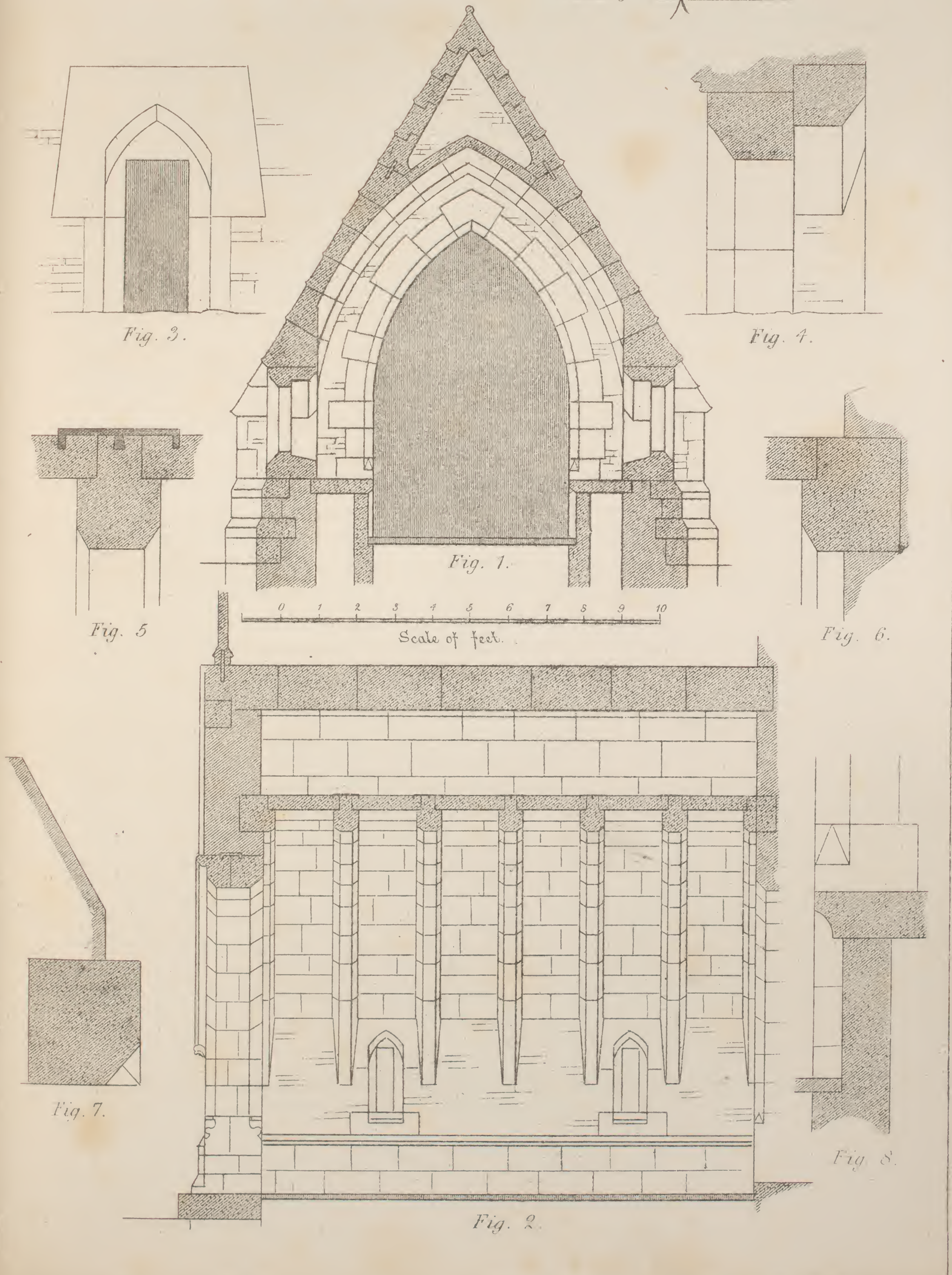
Fig. 4, a section through the same, showing the relative positions of the outer square head, and the inner arch.

Figs. 5 and 6, are sections respectively of the principal, or intermediate, and the end, or wall ribs of the roof to an enlarged scale, showing in the first the iron cramping connecting the ribs and slab stones between the same. It will be seen that the former are rebated for the reception of the latter.

Fig. 7, shows a plan, or horizontal section, of the jamb of the inner door, seen in elevation in *Fig*. 1, and

Fig. 8, is a vertical section, showing the riser and the front, or molded, edge, &c., of the stone seat.

Gothic Porch No. II.



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It will be remarked, that in the case of the Felkirk porch, and in the example just described, the construction is that of the simple pointed vault, as appears also to have been the plan followed in the Early English porches at Barnack, in Northamptonshire, Middleton–Cheney, and Chacomb,* as well as in several other instances in the smaller porches of the stone counties. A very beautiful example of the vaulted roof to a shallow porch occurs at Higham Ferrars, though this can hardly be classed among the small. Some very early instances, however, occur, in which the groined forms of roof were adopted for the porch. The Norman porch of Sherborne, in Dorsetshire, has a groined roof. The Early English south porch of St. Mary's Uffingdon, Berks, has also one, and some others might be enumerated. In the Decorated and the Perpendicular periods, the groined roof became common, partaking, in the latter, of all the varied character and enrichment exhibited in the larger roofs of the same description. There is a fine Decorated groined roof in the south porch of Leverington church, in Cambridgeshire. Cowdray porch, before referred to, is a rich one of the domestic class; but it will be hardly requisite to enter into enumeration of the examples of either periods in which the groined porch appears, a number will at once be remembered by most who are in any way connected with the study or the operative functions of masonry. The principles of construction employed in groining generally have been before discoursed upon, when speaking of the larger roofs so constructed. It will be sufficient to say that the same are followed and exhibited in the subservient features; so that, in designing or constructing a Gothic porch, if the few we have mentioned are referred to as a general guide to their treatment, chronologically and æsthetically, or with regard to date and taste, and the rules laid down are consulted for the practical considerations involved, it will hardly happen but that all the desired results, both as regards the one and the other, will be readily attained.

The more modern porch and its characteristics may now, perhaps, be properly considered. These are as varied in the nature of their design and aspect as are the varying tastes formed by the different prejudices, education, and habits of the designers, or of the patrons for whom they are designed. They should be less dependant upon such unstable and irresponsive source. A Classic porch should be Classic in principle, and in the proper adaptation of Classic features, to the wants and requirements of a present state of society, not a mere assemblage of parts merely copied and put together without reference to any such recognition of a different condition, as respects both country and habits, as is frequently the case. The spirit, not the letter of the original applications should be the point aimed at, keeping in view primarily, the useful purpose, and secondarily, the acknowledged standards of good taste in the disposition and ornamentation, according to the character chosen. This is important, if for no other reason, for that the entrance to a building, whether for public or private purposes, is probably the first point of the detail of the edifice which attracts attention, and is the harbinger, or exponent, frequently of what may be further expected of good or bad in its treatment generally. It is therefore no matter of indifference if the proper design of the porch be unattended to; for

* The stone ribs of this porch are of considerable size, and terminate in the manner distinguished by the French as "cul de lampe."—See *Dictionnaire Raisonnée, par Violet le Duc.*

there is a much more extended natural appreciation of outward forms and correspondence, and the consequent pleasing sensations to be derived from the view of them, than is for the most part thought of. Truthful and appropriate representations of all kinds almost intuitively recommended themselves. Providence has arrayed the world, it has been remarked, upon these considerations. Shall we, then, esteem it of little consequence whether or not we follow such precept, where, perhaps, we need its healthful and pleasurable influence the most? Architecture should be material nature as respects truth and propriety in its expression, and all production in architectural or other art, will be valuable in proportion as it is or is not founded upon an admission and exhibition of this all-governing rule.

But to return. In modern erections, particularly of the domestic kind, the porch has the advantage of its prototype the portico. It can be less arbitarily applied, and can with greater propriety be treated more or less as an enclosed erection, as required by this climate.

The design for a porch shewn in *Plate* 17, is one of a character suitable for an Italian house or villa, either isolated or otherwise. It is partially enclosed, having the side arches filled in, and pierced with a smaller opening, which might be glazed with plate or ornamental glass. The construction shewn in the plate is brick, cemented over, and jointed in what are called Greek rustics. The same, however, may be wholly of stone formation.

Fig. 1, gives a perspective view of the porch, the projection of which is shewn as equal to the breadth of it. This projection may be greater or less, as occasion may necessitate, but it should be arranged that the springing line of the arches at the front and sides should be the same. It is better generally, where the semi-head is adopted that the arches should be all of the same width also, as in the example here given. The effect is less agreeable when, from a difference in the span, the side arches do not reach the height of the front one. Modes of accommodating this, will, however, readily occur. In porches of any size, the front might be arranged as a main arch, with a smaller one on each side, with which latter, the arches of the lateral faces might agree; or two large arches, resting on a coupled centre column, and springing from engaged columns and piers at the angles, would afford the opportunity of introducing a similar height and size of arch at the two sides, and have a very good effect.

Fig. 2, is an isometrical plan, taken above the plinth of the porch, shewing the stone step and flooring of it, the brick construction of the piers, &c., and line of finishing of the cement. It will be seen here as well as in the perspective elevation, *Fig.* 1, that the jambs of the front arch take in part a curved form, those of the side arches being square throughout. This gives breadth, and is a desirable arrangement in many cases, not only in porches, but in doors. The doors to the London and Westminster Branch Bank, Holborn, may be referred to, among several others, as shewing the adoption of the plan with good effect.

Fig. 3, is a vertical section through the cornice and parapet, &c., taken at A, on the elevation, shewing, as on the isometrical plan below the brick-work of the structure, the stone core laid therein for the projecting cornice, the ballaster of the parapet with its stone capping, and the line of the cement with which the moldings are formed and the surface covered.

Fig. 4, is a like section through the window sill and dado, or filling-in, of the side arches,

DESIGN FOR A PORCH.

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PLATE 18

DESIGN FOR AN ITALIAN PORCH.

Scale of Feet

H Weiss Sp

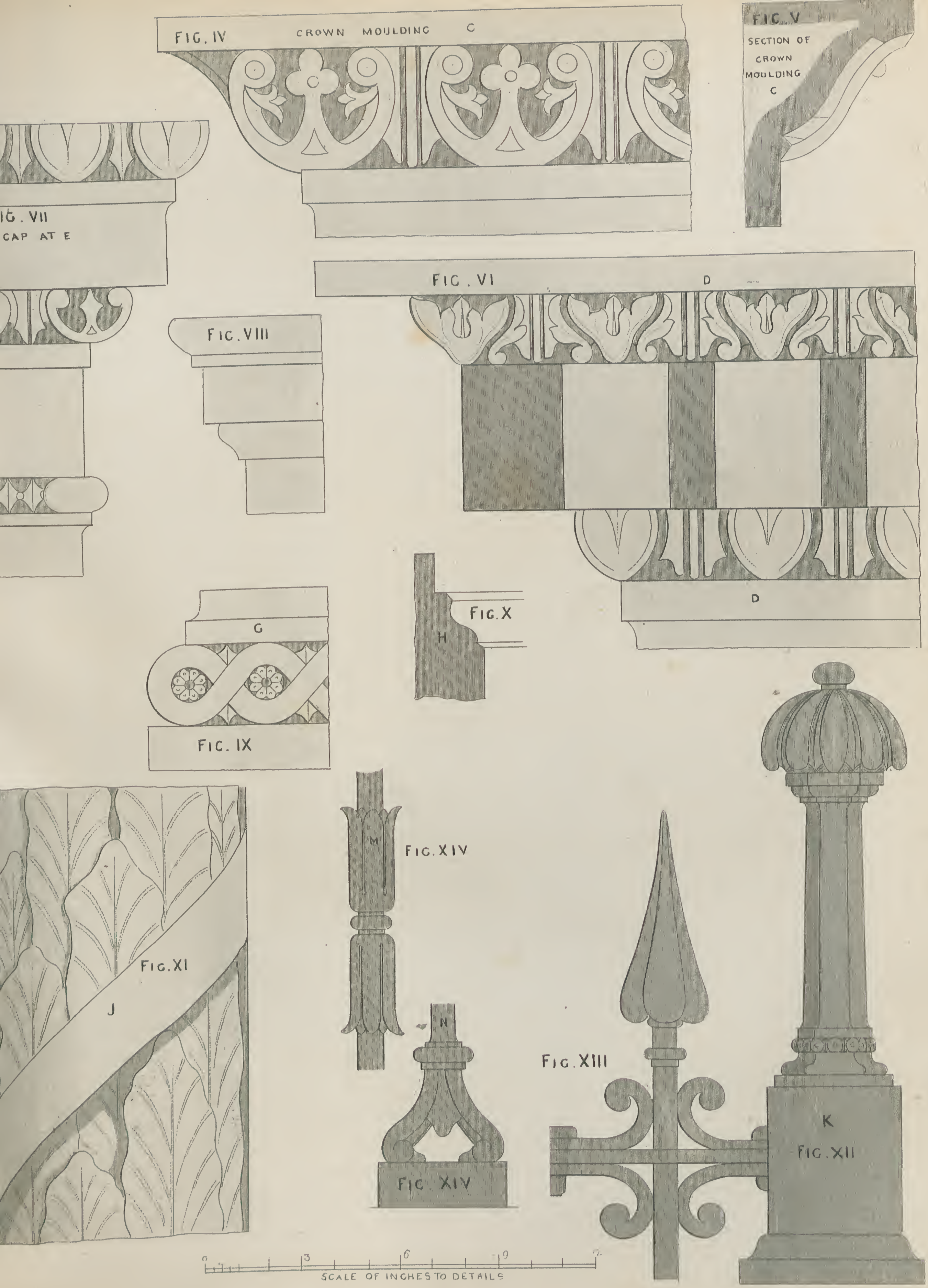


FIG. IV
CROWN MOULDING
C
FIG. V
SECTION OF CROWN MOULDING
C
IG. VII
CAP AT E
FIG. VI
D
FIG. VIII
G
FIG. IX
FIG. X
H
D
FIG. XI
J
M
FIG. XIV
N
FIG. XIV
FIG. XIII
K
FIG. XII
0
3
6
9
12
SCALE OF INCHES TO DETAILS

taken at B, on the elevation; shewing, in the same manner, the mode of forming and finishing this part.

The scale of these details, that is to say of *Figs.* 2, 3, and 4, is twice that of *Fig.* 1.

Plate 18, exhibits another form of the Italianised Classic porch. The projection in this case is but slight compared with the former, and it exemplifies the horizontal, instead of the arched treatment. It is also without the parapet, and shews a construction altogether of stone; stone being also the material in which the doorway connected with it is formed.

Fig. 1, which gives a geometrical elevation of the front, shews, as will be seen, on the one side a plainer, and on the other a richer treatment of the same general arrangement. This latter exhibits the application of bold angle pilasters as the termination of the outer or inclosing wall, the consoled cornice and blocking of which, being a projected return of the general one, supports a vase, and forms the advanced jamb or pier to inner antæ, or rather subservient pilasters, which carry the front frieze and cornice of the entrance. This frieze and cornice is on the one side without ornament, the latter being simply denticulated. The same absence of enrichment is also evidenced in the lower plinth, the pedestal of the railing, and other parts. On the other, or left side, on the contrary, the frieze and pilaster face has each a sunk panel filled with a scroll ornament, and the moldings are all enriched. The base and the blocking course are also ornamented with carving, and there is an acroteria, or crowning ornament, introduced upon the latter. In the plinth and pedestal, as well as in the railing standard, the same character is further carried out.

Fig. 2, is the profile, or side elevation, in accordance with the plainer version shewn in *Fig.* 1, and,

Fig. 3, a section taken through the centre of the porch, also according to the plainer example, shewing the nature and the arrangement of the stone construction, and the manner in which it attaches itself to the brickwork of the main building, of which it is presumed to be a part. In both these last figures ornamentation agreeing with the richer elevation, or of any similar kind, might of course be introduced, in which case the more free descriptions of stone would have to be employed, which in the other are not so much necessitated.

Plate 19, in further elucidation, gives the detail of the moldings, and an idea for the enrichments when employed.

Fig. 4, is the cymatium or crowning molding of the cornice, with the upper member or fillet of the corona, (marked C, in the front elevation, or *Fig.* 1, *Plate* 18,) to an enlarged scale.

Fig. 5, is a section through this molding, shewing the relief of the ornamentation.

Fig. 6, shews an elevation of the dentil band and bed-mold, with the enrichments thereon, marked D, in the elevation on former plate.

Fig. 7, is a like elevation of the inner pilaster cap, &c., at E, with its ornaments.

Fig. 8, gives the capping of the retaining wall, or dado, at the side of the entrance, on which the return railing and its standards are fixed.

Fig. 9, is the enriched base of the inner pilasters.

Fig. 10, a molding for the base of the dado or retaining wall.

Fig. 11, is the enrichment in the panel of the outer pilasters.

Fig. 12, the iron standard, into the base of which the top rail of the railing is inserted.

Fig. 13, the top rail and spear head of the latter, at large.

Fig. 14, the centre ornament, and foot of the same.

CHAPTER XII.

ON WINDOWS.

In reference to modern design and requirement in Architecture, windows bear a conspicuous part. In that of ancient Greece and Rome this, generally speaking, was less the case. In the first, as far as we know of their domestic edifices, windows were small and very few in number. According to Seneca, says Stuart, the windows of the baths of Scipio were merely small loops or crevices in the wall, hardly claiming the name of window. and at Pompeii, the houses shew that it was not a general custom in towns to have many windows.

The rooms which surrounded the courts or atria shew no windows on that side, the same being here either open to the court, or lighted by the doorway. A few small openings occur only in some towards the street, placed high up in the wall. Windows are, however, in some few instances observable in the rooms which look out upon the gardens.

With the progress of Roman luxury, windows received a more commodious and extended disposition. Prospect, as well as greater amount of light, appears now to have been more considered. In the country seats of Pliny, at Laurentinum and Fusci, says Stuart, the windows were numerous and extensive; and there are several other Roman buildings which exhibit the like instances, and at the same time establish the general proportions and character to be followed in modern imitations or adaptations of the Classic forms of this feature. It is to these sources that the architects and artists of the revival period referred, and from whence they have drawn the rules, which, modified according to climate, purpose, and other particulars, have been received as the standards for modern production of the same kind.

The principal difference in the forms of the ancient, and revived Classic window, has relation to the shape of the aperture. In the ancient examples the head is more usually straight, and the sides of the opening vertical, forming a rectangular opening, though there are examples of windows with inclined sides, as in the case of doors; and these apertures are usually finished with an architrave, or antepagmenta, with cornice moldings above, after the fashion exhibited also in the latter. In more modern instances there are commonly three

different forms employed, the first and more general being the straight head or lintel, the second, the semi-circular head, and the third, the segmental. Vitruvius, Palladio, Scamozzi, and other authors have each treated on the proportion of the two former, but they necessarily vary for a variety of reasons. The medium proportion of windows of the first description has been given and generally received, as twice the width of their aperture in height; the breadth of the antepagmenta being a fifth, or from that to a sixth, of the width of the opening; the height of the entablature to the upper fillet of the cymatium of the cornice from one-third to one-fourth of the height of the aperture. The architrave and freize should be equal in height, and the cornice may be augmented one-fifth or one-sixth more than the height of the two latter members. This rule has been generally adopted in the most celebrated edifices at Rome and Florence. According to the story, however, in which the window is placed, these proportions may be slightly varied, those of the ground story being reduced an eighth part, and those of the superior story being increased in like ratio. For the chamber floor a usual proportion is the diagonal, or once and a half the breadth, as in the façade of the Louvre. In the attic, the square, or equal height and breadth, is a usual proportion, and to mezzonine floors a good measure for the windows is three quarters of their breadth in height. These proportions are not, however, as before said, arbitrary, but are given as general rules to be followed subject to the modifications called for by particular circumstances and restrictions.

In the circular-headed window, particularly of what is called the Venetian kind, the proportion of two squares is still retained where such is employed in the principal story, the space included in the semicircular head being added to the height, making a total of two and a half of the width. The side apertures to these Venetian windows are very varied in their proportion; a third of the width of the centre light has a good effect, but in some Italian buildings they are wider. Where a large body of light is required, two-thirds may be given; or, if the window be very large, divide the middle void into five, and give two parts to each of the sides. Of semicircular headed windows of this and other kinds, variously employed, there are some very fine examples in the buildings of Florence; as well as in several of the other cities of Italy.

In ground stories and in connexion with arcades of the orders, the semicircular headed window, necessarily, has an accordant proportion with the arcade with which it is employed. It is to be observed that, so used, the window arches should be struck from the same centre as those of the arcade, and to proportion the window to the restricted width of the former, the same is usually found placed upon a plain continued pedestal, balustrade, or elevated string-course. The two first-mentioned are indeed very prevalent modes of finishing the lower portions of Classic windows generally, as associated with the subdivisions of height or surbaces of the elevation in Classic design.

Of the segmental-headed window, many ancient examples do not appear; but of the period of the revival, and subsequently, there are several specimens. They occur in the façade of the Louvre towards the river, and throughout the basement story of the side towards St. Germain l'Auxérois. In the first case the proportion is the diagonal, measured from the sill to the

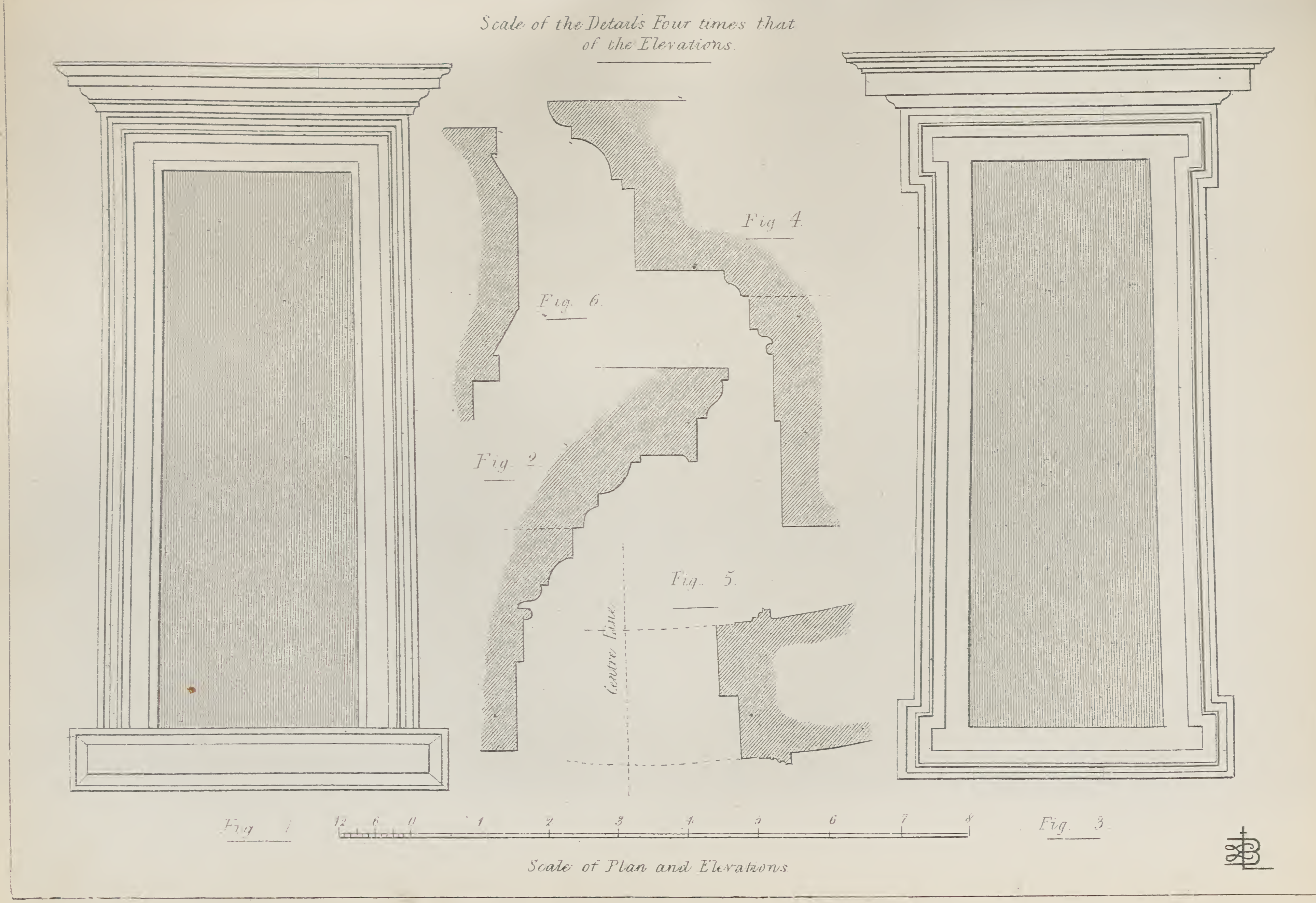
spring of the segment. In the second, the proportion of height to width is more than usually extended, the former being two and two-thirds of the latter, taken to the spring of the segment. (See *Plate* 20*a.*) In many Italian buildings they are observable, and in the architecture of the present day they are very common.

It would be impossible to enter into description of all the varieties exhibited in the treatment of Classic windows, either ancient or modern; and it is also unnecessary, seeing that examples themselves can be referred to. In the case of the former, perhaps to less extent than might be desired; but in that of the latter in innumerable instances, all more or less professing to be founded on ancient example, and exhibiting the characteristic features of the same, accommodated to the uses and requirements of the present time.

Of such of these as appear in the works of the great architects and artists of the early Italian period, the list would be too voluminous to enter upon. It will be sufficient for the present purpose to mention a few of the principal examples which exist in our own land, and to which reference can consequently be more readily made. These are the windows of the Banqueting House, Whitehall, the work of Inigo Jones; those of St. Paul's and Greenwich Hospital, and some at Hampton Court, and in the various churches of Sir Christopher Wren. Several good windows also occur, among other features, at Blenheim, Castle Howard, Yorkshire, and King's Weston, near Bristol, by Sir John Vanburgh; some, by Hawksmoor, at St. George's Church, Bloomsbury, and St. Mary Woolnoth, Lombard Street; by Gibbs, in the church of St. Martin, London, and in his other works at Oxford and Cambridge; and by Kent and Brettingham, at Holkham Hall. Burlington House, Piccadilly, has also some good Classic windows; and last, not least, may be noted those of Somerset House, by Sir William Chambers.

These are all of the earlier or severer revived Classic type, but are worthy of very attentive examination, and are among the best models of correct proportion and satisfactory general treatment.

Of more modern windows of the Classic kind, there are several very good examples in the works of Cockerell, Tite, Smirke, Barry, and other architects of the present day. There are some well-treated windows in the Earl of Ellesmere's house at St. James's; and those of many of the London club houses and lately erected buildings in the City, present very valuable and suggestive applications of this feature. In reference to these, however, it is to be observed that, though the Classic models in their purer phase are followed in the greater number, yet in many the more modern Italian element is largely introduced. There has been a growing tendency of late to depart from the strict Classic of the schools, and the restrictions formerly considered so essential to the production of a Classic building in its integrity. Under proper limitation, progress in this direction is very desirable. As has been more than once before remarked, it is the principle of Classic application that should be sought and followed, not the mere letter of its rules. The real architect will be fully alive to this; and keeping it in mind, there is no legitimate reason why the many beauties and advantages, both on the score of picturesqueness of appearance, and convenient arrangement, which many of the Italian buildings possess, should not be incorporated with the purer Classic, and, suitably associated



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therewith, be taken to be fitting and appropriate accommodation. of the older forms to new ideas and wants.

That this can be done with happy result proof has been given in several modern erections, where the spirit of the severe Classic models has been retained, and regulating the applications of the less arbitrary character of later similar features, has produced a result far from discouraging to those who seek to relieve Classic architecture from the trammels and restrictions imposed and insisted on by its earlier introducers here, and apparent in the majority of existing edifices both of theirs and a later age. On this point, however, observation might be extended to a very considerable length; such, however, not being immediately relative, we will return to the subject more directly in hand.

The general forms and proportions of Classic windows having been before remarked upon, a reference to *Plates* 20 and *20a* will afford, to some extent, what may be considered the necessary further illustrations of a graphic kind. Examples of ancient Classic windows, as previously noticed, are not commonly met with in a perfect state. In *Plate* 20, therefore, is given the nearest approach to the ordinary aspect of the same, in the restored version, by Palladio, of those of the Temple of Vesta, at Tivoli. In this Plate

Fig. 1, is the elevation of the windows from this authority, viewed externally.

Fig. 2, the section of the exterior architrave or antepagmenta and its crowning moldings, to a scale four times that of the elevation.

Fig. 3, is the internal elevation of the window, and

Fig. 4, the interior architrave and cornice, to the same scale as *Fig.* 2.

Fig. 5, is the plan of the window opening, taken just above the sill, at A A in the elevations.

It will be seen that the jambs of these windows are inclined, leaving the aperture narrower at the top than at the bottom, and so agreeing, as Palladio observes,* with the directions of Vitruvius, as given in the sixth chapter of his fourth book. It has been questioned, however, whether this inclination is properly admissible in the case of windows, or even in doors, as is more prevalent. One author,† applying the observation to a similar practice in reference to the latter says, "While we admire the dignity of the Grecian or the pomp of the Roman doors, let us see also this contraction as an egregious error; and if we refer to Palladio, or to the oracle of Palladio, Vitruvius, on this account, let it be to dissent from their opinions. If we turn our eyes to the Temple at Tivoli, let us place the door there as an object shewing what we should avoid." And he goes on to say, "with regard to the Italian," (that is to say, Palladio,) "we have shown that he was lost in the diversity of what he read and what he saw; as to the Roman (Vitruvius), he seems to have received it as a law in the science, that there should be this contraction; and when he directs that in doors of more than thirty feet in height in the opening there should be no contraction of the diameter, his commentator, Philander, who rarely misses his sense, says this was because at that height the nature of vision answered

* Fourth Book, chap. xxiii. p. 234, edit. London, 1735.

† Ware,—*Complete Body of Architecture.* London, 1756.

the same purpose, and the contraction was given to the eye by distance." However this may be, it is certain that many of the best Greek examples show this contraction. It appears in the Erectheum, in the Temple of Hercules at Cora, and in several other instances. Among the Romans the practice seems to have been less followed, and particularly in the case of windows, notwithstanding the Vitruvian authority. Most of such evidences as remain indicate the parallel aperture, and such appears generally in the revived Classic period, and up to the time of the Grecian introductions, through Stuart and Revett, and others.

In the second of the plates to which reference has just been made, viz. 20*a*, we have three windows, two from the river façade, and the other from the basement of the grand peristyle of the Louvre, the work of Claude Perrault; examples of the Classic revival only slightly removed from the Palladian restoration given in the previous plate. Here *Fig.* 1, is the elevation of the windows of the principal story of the first-named front, *Fig.* 2, being that of the story above.

It will be seen that the first has the straight-headed parallel aperture, surrounded by an architrave of a proportion of rather less than a sixth; the height of the former being twice and a third of its width; an extended proportion which seems to be carried out in the windows of the basement, shewn as *Fig.* 3. Beyond the architrave proper is, as frequently occurs, a plain face, to receive carved consoles, which support a cornice and pediment. The freize is formed as a sunk panel with end ornaments. The lower part of the window is open, or continued, as will be observed, to the floor, a usual practice in French architecture. Altogether this window, as are several others in the same building, is very effective and pleasing, and a good model for the moderately ornamented Classic window.

Fig. 2, is an elevation of the windows of the second story, which afford an example, as do those of the basement of the main front, given in *Fig.* 3, of the segmental head. These are comparatively plain, having a simple architrave, produced in return at the upper part of the sides, and continued round the bottom.

Fig. 3, shows a like elevation of the windows of the sub, or basement, story of the main peristyle or front. These, as previously noticed, have the segmental head, on the centre of which is a plain projecting key-stone, and an architrave of a proportion between a fifth and a sixth, produced in return at the upper part, like those of the upper story of the river front, resting on a sill, supported by two plain consoles. The aperture has a more than usually extended height, compared with its width.

Fig. 4, gives a section through the cornice and pediment of the principal windows, shewn in *Fig.* 1, at large, and

Fig. 5, a similar section of the architrave.

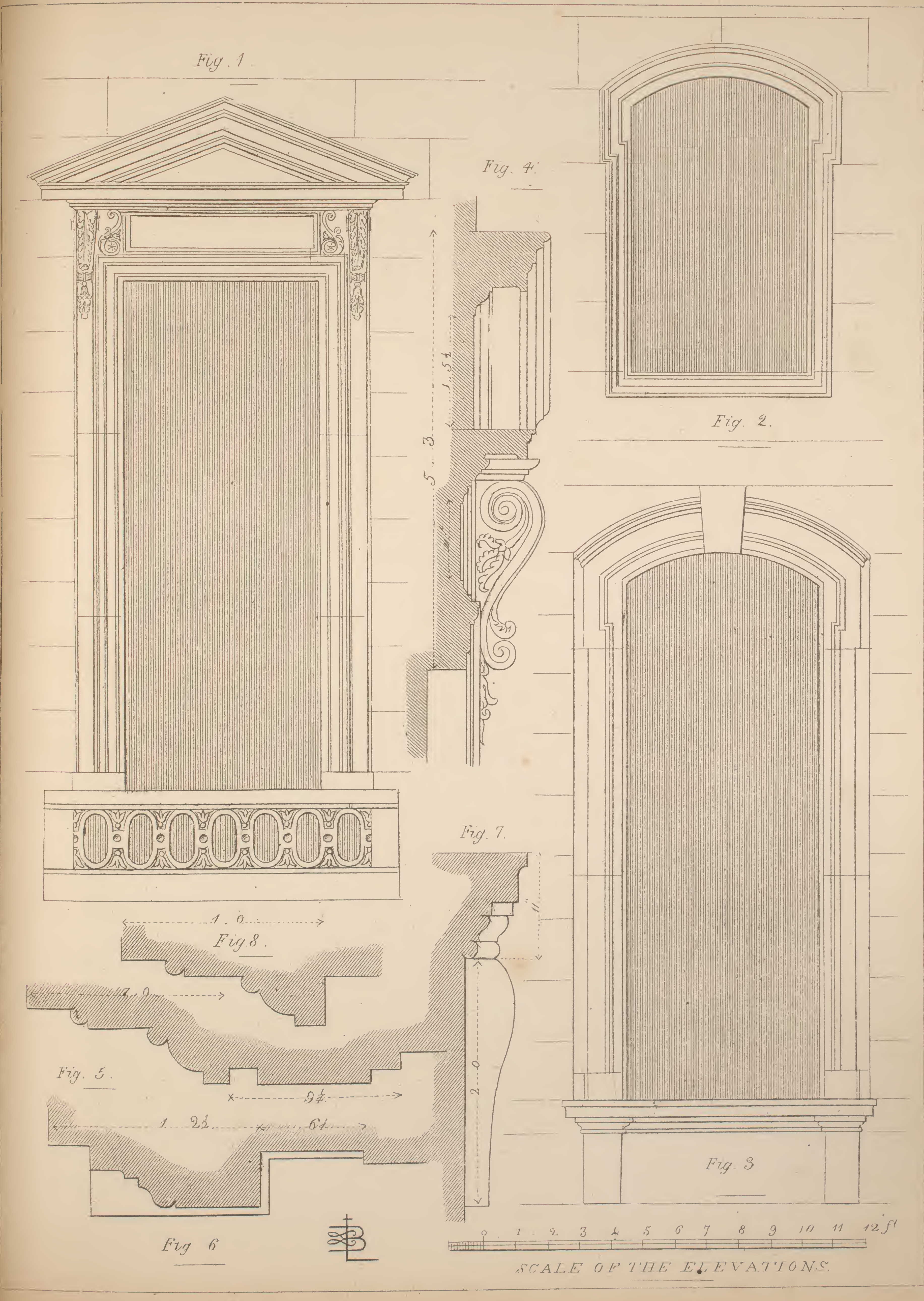
Fig. 6, is a section, enlarged, of the architrave of the lower windows, shewn in elevation *Fig.* 3.

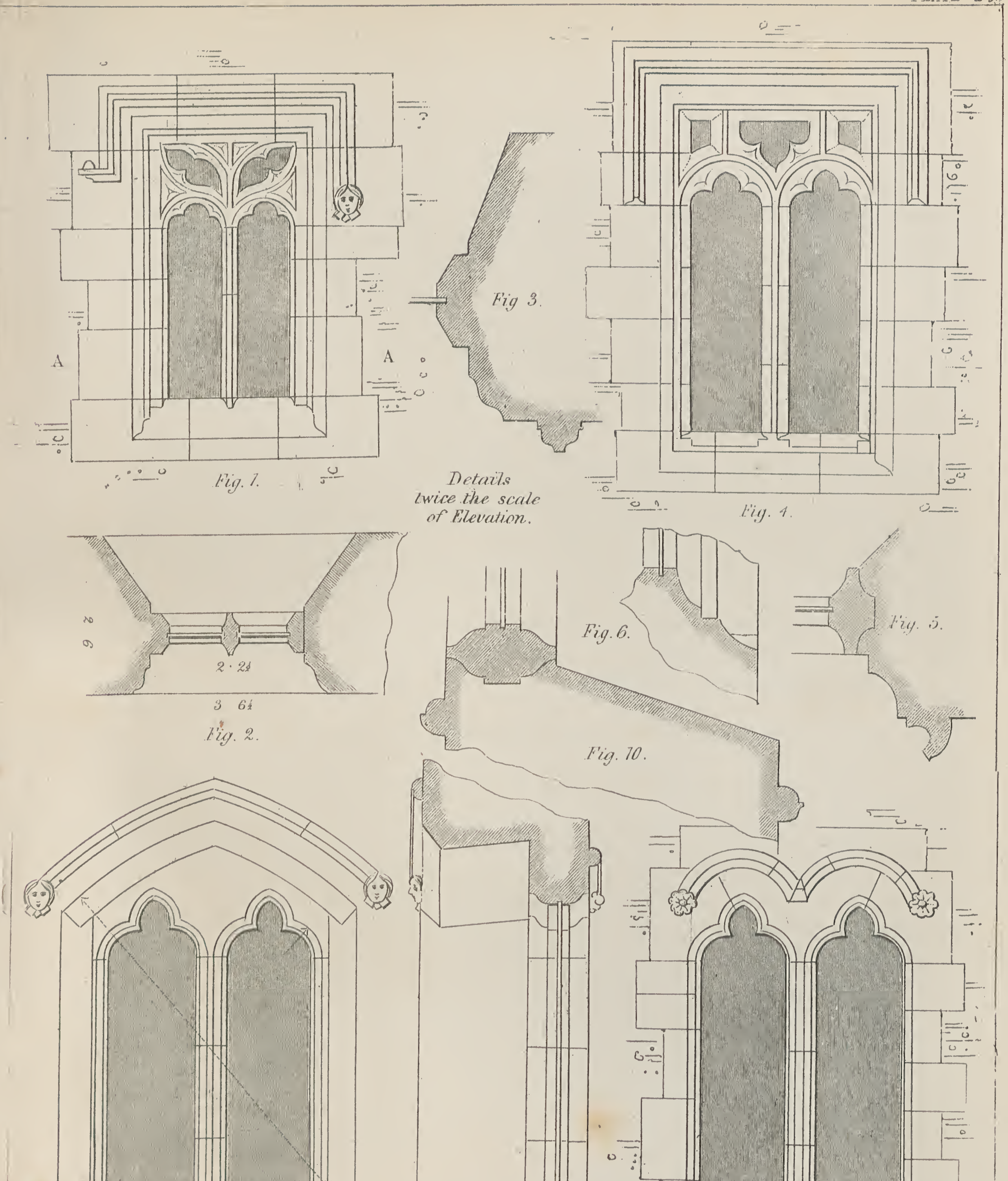
Fig. 7, the profile of the console and section through the window-sill, and

Fig. 8, a section through the architrave of the upper windows, shewn in elevation *Fig.* 2.

From these illustrations of the earlier introductions of the Classic form of windows, and previously to following out the same in their still more modern applications, it will be

WINDOWS CLASSIC-PERRAULT.





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requisite, perhaps, to say a few words on the subject of the windows of the mediæval age. These are of the most extensive variety, and must not be deprived of their due share of consideration and study on the part of the mason. As far as the labour and skill required in the execution of the majority of the windows of this period is concerned, there is considerably more to interest and be acquired than occurs for the most part in the Classic styles. Many of the Gothic windows are highly interesting and valuable evidences of masonic skill, and it is particularly essential at the present time, when so much is being done, and so many buildings are being restored or erected of this character, that the required attention should be given, and the proper knowledge of how to deal with the subject, both artistically and practically, acquired.

The Earlier Gothic windows shew less intricacy, and more simple modes of treatment than afterwards became common. The Norman, or Romanesque windows, as well as the majority of those passing under the denomination of Early English, or Early Pointed, are generally single openings simply, more or less large, with circular or pointed heads, and undivided by mullions or traceries, as at a later period. Some Norman windows have centre shafts, and some Early English have more than one opening under the same outer or main arch, but these latter are constructively so many single and separate windows, having their heads formed from individual centres, and, in general, separate drip-stones, as exemplified in the window, *Fig.* 8, in *Plate 20b*, as well as in a variety of other instances that might be enumerated.

The more simple form of the Norman window is a semicircular-headed opening, with an inside splay of a greater or less extent, the outside jamb being of no great depth, sometimes with a plain chamfer and sometimes square. The next form has a deeper external jamb, and the addition of shafts filling its angle, supporting a secondary face or archvolt formed in continuation of the jamb round the arched head. A very simple and early window of this kind is given in the "Oxford Glossary," from Sandford Church, in Oxfordshire. A similar, but later arrangement of window is given in the same authority from the clerestory of Christ Church, Oxford, where some have the semicircular, and others the pointed head. Another, and very usual kind in small rich buildings, has no shafts, but the molding is continued round jamb and head, the outer being a plain shallow reveal, the next, a plain face with a bold circular molding, or boultine, at the angle of this and an inner deeper reveal. Of the Norman window with the centre shaft, a very rich, and otherwise interesting example, is given in the "Oxford Glossary," from Sutton Courteney Church, Berks. There are plainer ones also at St. Albans, and in the circular Norman Belfry Towers of Norfolk and Suffolk they are very common.* In these it has been remarked that there is usually, however, no provision for glazing.

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* This has been termed the Baluster window, and has been noticed in buildings which are generally considered as of Saxon age. Wickham, Berks, and St. Benets, Cambridge, both figured in the *Oxford Glossary*, are instances.

Generally speaking, the decoration or chief ornamentation of Early English windows is on the inside, and this is the case when the exterior is of very plain character; some, however, are correspondently enriched on the exterior. At Lincoln, and Warmington, Northamptonshire, there are windows of this sort. Some also occur at Croxden Abbey, Staffordshire, and others may be added. Of the plain exterior and more highly enriched interior, two curious examples are given in the "Oxford Glossary," from Shipton Ollife, in Gloucestershire. The first of these has plain lancet lights externally, and on the interior, arches ranging with the inner face of the wall, and springing from detached shafts at the sides and centre; the wall string being continued over as a hood-mold or label to each arch. The interior jamb, which is not produced from the pier between the windows, but being stopped at the soffit of the arches leaves the centre shaft entirely free, is a plain splay of some depth and spread, and the shafts have molded caps and bases of bold character. The second has two square-headed lights externally, and internally two trefoil-headed arches, which rest at the sides on an impost and bracket, and in the centre, on a shaft which terminates the produced pier of the exterior opening, and finishes, as in the other case, with molded cap and base. The jambs here are also plain splays, and the slope of the cill is considerable. Of all descriptions of these internally-shafted windows, however, none are more beautiful than an example exhibited at Stone, in Kent, and also in the aisle of the nave at St. Albans. The former is shewn in *Plate* 152 of the "Oxford Glossary;" and it has also been engraved in an account of Stone Church, published by the late Mr. Edward Cresy. The outer lights of this window form a double lancet with a quatrefoil above; the outside is a plain splay, and a deep plain splay forms the interior jamb or sides. The interior has a double trefoiled arch, with a quatrefoil above, corresponding in arrangement with the interior openings, springing from long, slender shafts, with richly-carved capitals and bases, within an including or outer two-centred arch, also springing from long, slender shafts, placed at or near the inner termination of the splay. All the arches, as well as the quatrefoil, are molded, and the whole is enclosed or finished by a molded label or hood-mold, with carved heads. The bases of the shafts die upon a deeply-splayed window-cill, the centre shaft being freely and wholly detached; beneath which runs the inverted string-course of the interior. The window alluded to, as at St. Albans, is of a similar kind, and they are both, as respects internal treatment, among the finest and most satisfactory of the windows of this period.

Of a late coupled Early English window, in which the division between the lights, usually of some width, is reduced to the size and character of the mullion of the succeeding style, of which there are some examples, an illustration is given on *Plate* 20 *b*. Here, differing from both the plainer and richer forms of Early English just described, the lights are included (see *Fig*. 7), under one main internal arch, as is commonly the case, not only in two-light windows, but also where this number is exceeded. This arch, in this instance of two flat sweeps, dies, as will be seen, on the splay of the jamb, above the springing of the trefoiled heads of the recessed lights, and is finished with a label following the same curve, stopped with carved heads. In some cases these internal arches take a less flat form, and spring from a lower level than the outer lights, the point or apex being also lower than that of the latter, forming thus a more

or less inclined soffit, as is shewn in the section *Fig.* 9. These inner arches have generally a simple splay, or chamfer, on their inner angle, dying upon the plain splay of the jamb They are sometimes, however, molded and rest upon corbels. It will be observed that the mullion is here molded, both externally and internally, and that the molding is carried round the trefoiled head in each case to correspond. The exterior has a hood-mold preserving the character of the separate arch over each light (see *Fig.* 8), and the glazing is recessed but slightly from the external face of the wall, according to the usual practice at this date.

Fig. 10, in the same plate, gives an enlarged section through the window-jamb, shewing the plan of the mullion, the splay of the jamb, and the contour of the inside and outside labels.

This window is from the chancel of Treeton Church, in Yorkshire, but is given as an example of a kind by no means necessarily limited to an ecclesiastical application, but as one which might be well otherwise made use of.

The next kind of window for consideration is that usually distinguished as the Decorated. These are among the most elaborate of medæval windows, and they are those in which, as before observed, a much larger amount of masonic skill in the construction of them is called for than in the majority of those of the preceding style. The complexity of plan and arrangement exhibited in many of the later Decorated windows is very great. Some very beautiful and elaborate evidences, among a very large number which might be enumerated, exist at Howden, and in the chancels of Chaddesley Corbet, Worcestershire, and Cliffe, in Kent; one of them, from Chaddesley Corbet, forms the subject of *Plate 20c*, to which reference will be more particularly made hereafter.

The earlier Decorated windows are, as might naturally be supposed, less complicated in their treatment. In these, Rickman says, the "clearest marks of the Decorated style are to be found," and he describes them as "very various, yet all on one principle," and which he thus defines:—"An arch is divided by one or more mullions into two or more lights, and these mullions branch into tracery of various figures, but do not run in perpendicular lines through the head." Of this tracery he distinguishes two descriptions. The first, generally, he considers, the oldest, has the figures, such as circles, trefoils, quatrefoils, &c., all worked with the same molding, and do not always regularly join each other, but touch only at points. This is denominated by him, and since by others, geometrical tracery, of which the nave windows at York, those of the eastern choir of Lincoln, and some of the arcades of the Cloisters at Westminster, and most of the windows of Exeter, are among the clearest examples.

In the smaller churches this plainer description or character of the moldings, forming the tracery, is the common form in which it appears. The tracery is here usually formed out of a plain splay. Northfleet Church, in Kent, has some very good examples of the Decorated window of this kind. Many others also shew the same absence of molding upon either mullion or jamb, the pattern of the tracery, however elaborate, being formed simply from the splay; two instances of this from Northfleet Church, above-mentioned, are exhibited in the wood cut in p. 127; the first, *Fig.* 1, shewing a curious and somewhat enriched form of tracery, and the other, *Fig.* 2, a more simple and pleasing character. *Fig.* 3 shews a section of the jamb and mullion, which are alike in both cases.

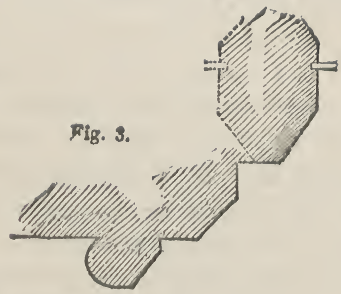
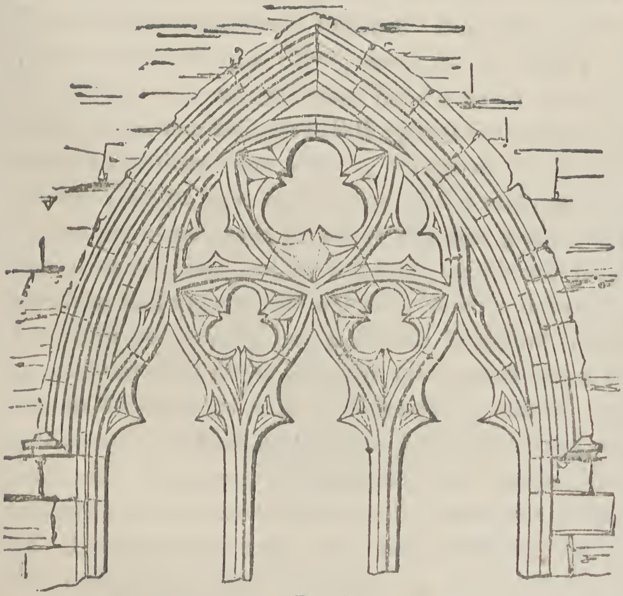


Fig. 3.



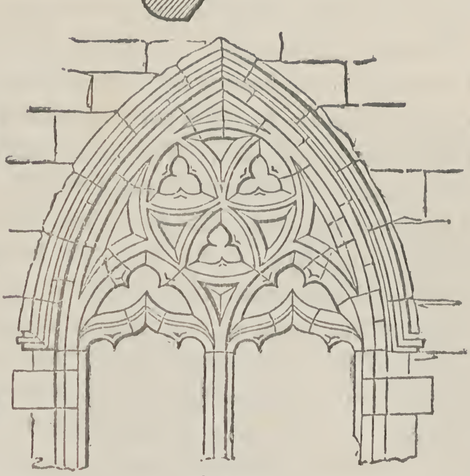


Fig. 1. Fig. 2.

In the larger and richer buildings there are generally "several subordinations of mullions," agreeing with Rickman's second description of tracery, which, from the direction of its component lines, he calls "flowing tracery," and of which, he says, York and Beverley Minsters, St. Mary's Church, Beverley, and Newark Church, contain the most beautiful specimens. In these traceries the principal molding often runs up only one or two mullions, forming part only of the general or larger design, "all the small figures being formed in moldings which spring from the sides of the principal." The jambs of the windows of this kind are often enriched with many moldings, the principal ones being sometimes treated as shafts. The windows to the aisles at Howden have very fully molded jambs, and they shew also, to some degree, the superimposed and subordinate arrangement just noticed.

The arches of Decorated windows are most commonly the equilateral. Sometimes, however, other forms, such as the lancet, the drop arch, and the square head occur. A good window of this latter sort, from Kiddington Church, Oxon, is given in the "Oxford Glossary;" and there are some of a larger size than usual in Westwell and Charing Churches, Kent. A square-headed Decorated window, of the simpler kind, is shewn in *Plate 20b; Fig.* 1, being its exterior elevation, and *Fig.* 2, its plan; and *Fig.* 3, an enlarged section of its jamb and mullion. At Westwell and Charing these windows are without the label or hood-mold, which Rickman notices as being sometimes omitted in the counties where the flint and chalk construction prevails. The example from Aston Church, Yorkshire, before referred to as given in *Plate 20b*, has the label, which is of rather unusual section, and finishes, on the one side,

on a carved head, and, on the other, in a simple return. There are also circular, and other different-formed windows of this style; but, except in a few instances, they are not of any size. A very curious circular one, shewing a traceried arrangement of three quatrefoils within the main circle, taken from Berkeley Church, Gloucestershire, is given in *Plate* 163 of the "Oxford Glossary." Another circular window occurs over the principal entrance to the Hospital of St. John, at Northampton, given in Dolman's "Ancient Domestic Architecture;" and one of a diamond, or rather square, shape, set anglewise, with slightly curved sides, enclosing four conjoined quatrefoils as tracery, under a label following the curve of the two upper sides, from Whitby, occurs among the illustrations at page 409 of the first-mentioned work.

In the working of the plainer descriptions of Decorated window, such as those in which the mullions and tracery are formed of and from plain splays, no very great or unusual amount of skill is required. The ancient method of setting out the forms in these cases appears to have been very simple. The centre lines of the design intended to be produced were first marked from a full-sized draught upon the several stones of which the tracery and mullions were to be composed, and from these lines the width of the fillets and splays were measured off upon the face of the work, the latter being sunk to the required depth from the former, considered as representing the first or outer surface of operation. The subdivisions of the depth of the mullions and tracery seem to have been obtained, in like manner, from centre lines marked in the same way on their substance. The joints in the tracery of the outer heads were usually radiated in the direction of the centre, from which the forms were struck; those of the outer arch to the points on either side, from which the same was described. In the Northfleet windows, shewn in woodcut at page 127, this plan of setting out appears distinctly to have been followed, the centre lines being clearly distinguishable even to this day; and the principle of the jointing is also very readily perceptible.

In the more complicated designs, and where several surfaces of molding are introduced, the same method of setting out from centre lines appears also to have been observed, at all events to the extent of the main forms of the design. At Cliffe Church, before noticed, the windows exhibit traces of the centre lines upon the fillets. It is a similar method of procedure, in fact, to that adopted by architects in making a small scale drawing where all the lines of the design cannot, for want of space, be included. In these cases three lines only are generally made use of, the exterior ones, right and left, representing the outer, or, as shown in *Plate* 20c, the elementary forms of the mullions and

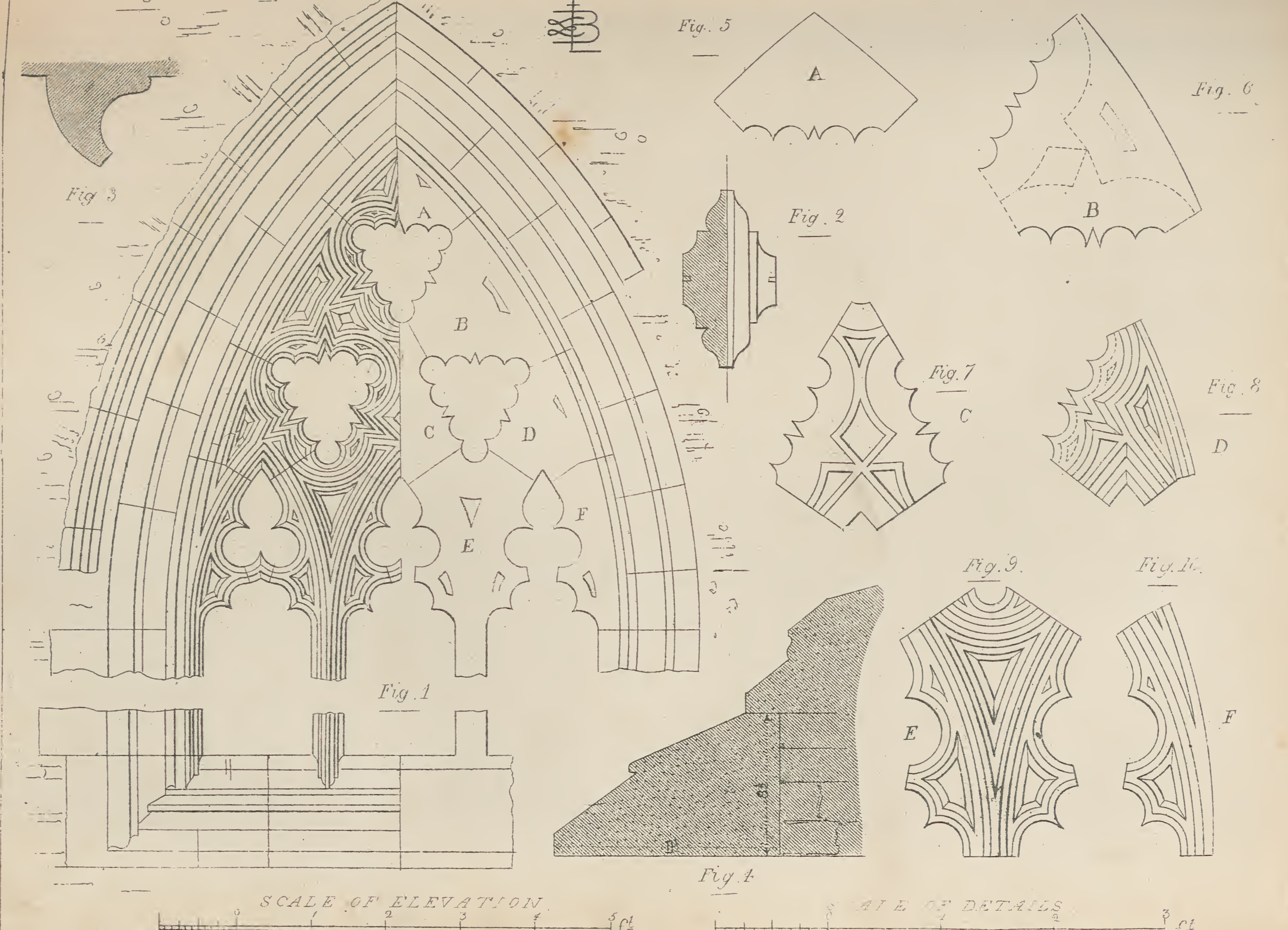


Fig. 1
Fig. 2
Fig 3
Fig. 4
Fig. 5
Fig. 6
Fig. 7
Fig. 8
Fig. 9
A
B
C
D
E
F
SCALE OF ELEVATION
0 1 2 3 4 5 ft
SCALE OF DETAILS
0 1 2 3 ft

tracery, and the middle one the centre lines of the same respectively, according to the diagram in page 128, which exhibits one of the windows of the aisle at Howden Church, so represented.

In *Plate* 20c, the several processes of this method of setting out are more particularly shewn, with reference to the separate pieces which form the head of the window, an elevation of which is also here given; *Fig.* 1, shewing on one half, the tracery in its first block or elementary form, and on the other half, the same in its perfected state.

Fig. 2, in the same *Plate*, is a section, also in two forms, namely, the first block and the perfected, through the mullion.

Fig. 3, is a section through the label or hood-mold, shewn on the completed side of the elevation.

Fig. 4, is a section through the cill.

Figs. 5, 6, 7, 8, 9, and 10, are enlarged representations of the several stones A, B, C, D, E, and F, composing the head. Of these—

Fig. 5, gives geometrically the upper or key-stone A, in first block.

Fig. 6, the stone B, in first block, with the centre lines of the main fillet, or outer surface of operation, marked in dotted lines thereon.

Fig. 7, the central stone C, with the main fillet as roughed out, or indicated thereon, the remainder of the work being in block.

Fig. 8, shews the stone D, with the lines of the main fillet and its ogee, as worked thereon, and the line of the minor fillet of the cuspations marked in dotted lines.

Figs. 9 and 10, shew the lower or springing stones of the tracery, &c., with the outer fillet and ogee, and the inner fillet and hollow worked thereon, exhibiting the same in a perfected shape, ready for position in the head.

With reference to the window here given, as well as the others in the Chancel of Chaddesley Corbet, it is to be observed that they are among the most beautiful examples of their kind. The other stonework of this portion is also of exceedingly good and interesting character.

Perpendicular windows, which succeeded to the Decorated style just described, are very numerous. Rickman considers that " full half of the windows in English edifices over the kingdom, are of this style. They are easily distinguished from the preceding style," says this author, " by their mullions running in perpendicular lines;" hence the term applied by him to the style, " and by the transoms, which are now general." " The varieties of the last style," he continues, " were in the disposition of the principal lines of the tracery; in this they are rather in the disposition of the minute parts; a window of four or more lights is generally divided into two or three parts, by strong mullions running quite up, and the portion of arch between them doubled from the centre of the side division." Again, " the heads of windows, instead of being filled with flowing ramifications, have slender mullions running from the heads of the lights, between each principal mullion, and these have small transoms, till the window is divided into a series of small panels, and the heads, being arched, are trefoiled or cinquefoiled." In the later windows these transoms are often ornamented with small battlements, and sometimes with flowers, which, when well executed, have a fine effect.

This battlemented ornamentation of the transom is very prevalent in the late Perpendicular Churches of Norfolk and Suffolk. A pleasing arrangement of this kind is exhibited in the Chancel windows of Southwold, in the latter county.

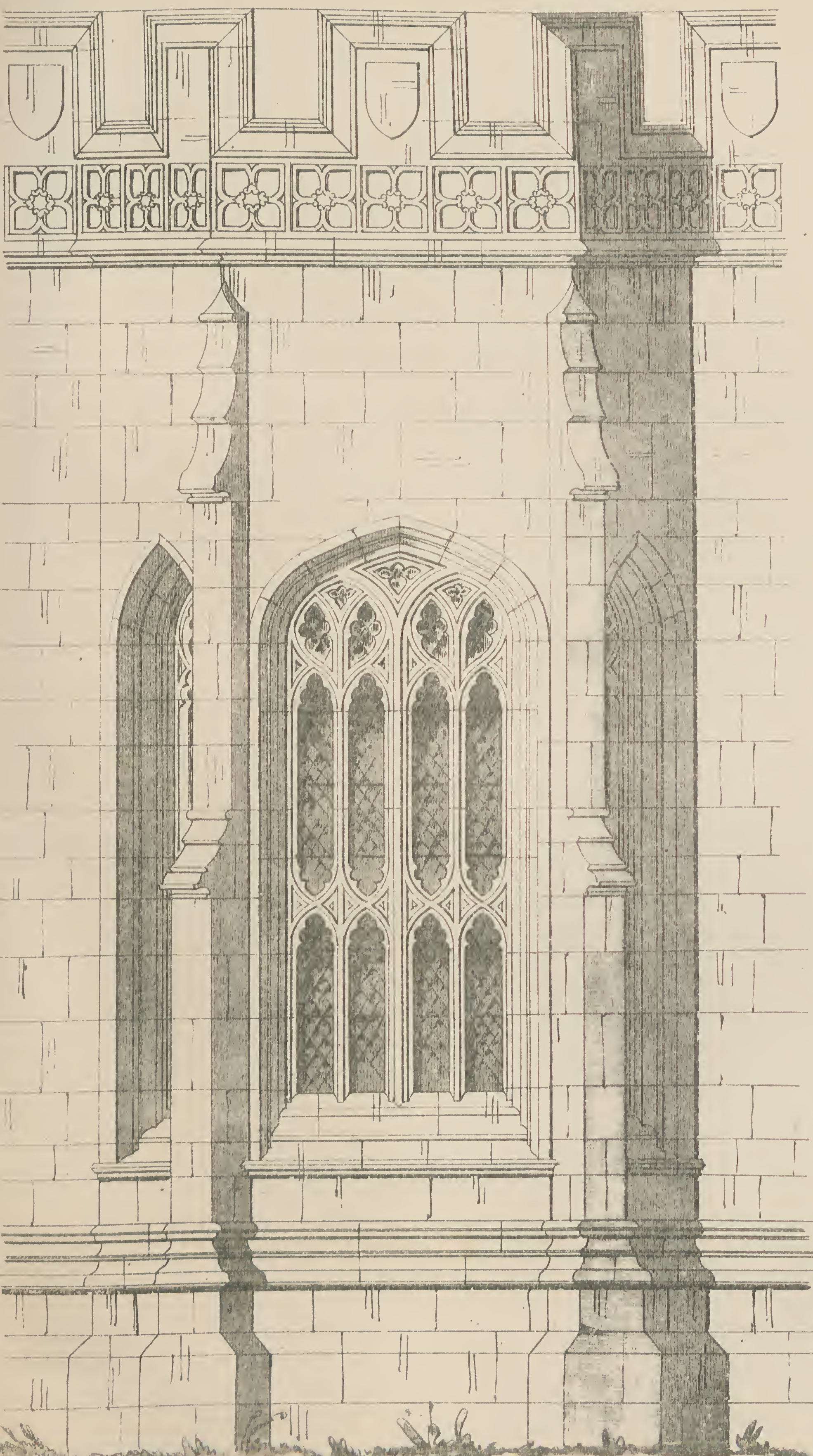
In the form of the outer arch there is but little difference in the early Perpendicular examples from that of the preceding style. The character of the moldings, however, differs. In the advanced period the window arches become of flatter sweep, and ultimately four-centred. Many late Perpendicular windows are without the arch, and flat-headed, the opening being divided into plain rectangular lights; this is particularly the case in domestic buildings. In some, the heads of the lights are arched and in some, the springing being kept low, there are piercings between the heads of the arches and the square head of the window. Of this arrangement, *Fig.* 4, in *Plate* 20*b*, is an example from St. Mary Magdalen Church, Ripon, in Yorkshire; *Fig.* 5, in same *Plate*, being a section of its jamb and mullion, and *Fig.* 6, a section through the cill.

It would be impossible to describe any more than in those of the preceding styles all the many varieties of Perpendicular windows which are to be observed. The plates to the "Oxford Glossary" shew several of the best kind, and Rickman particularises, as for a large window having no equal, the east window of York Cathedral. He also refers to those of St. George's Chapel, Windsor, for four lights, and to those of the Clerestory of Henry VIIth's Chapel, at Westminster, for five. The east window of the Beauchamp Chapel, at Warwick, he also mentions as an extremely rich example, having, "both within and without, many singularities."

Some of the finest and most interesting of the Perpendicular windows are what are usually called bay windows. These are the common feature of the halls of Perpendicular date, lighting the place of the high table or dais. Sometimes the hall has but one of these windows, in addition to those of the ordinary kind which light it. In other cases there are two—Crosby Hall, London; Raglan Castle Hall, Monmouthshire; Kingston Seymour Manor-House, Somersetshire; and Great Chatfield, Wilts; with a number of others, are examples of the former kind. Eltham, Thornbury, South Wraxhall, Wilts, are of the latter description. In plan the bay window is usually semi-octagonal, as at Crosby Hall; John of Gaunt's House, Lincoln; Compton Wingate, Warwickshire; Kiddal Hall, Yorkshire; &c., &c. Other forms are, however, frequently met with. Those at Eltham and South Wraxhall, are parallelograms. There is also a very interesting though small bay of this shape in the hall of Caistor Castle, in Norfolk. That at Raglan Castle is a slight projection of three faces, the two sides wider than the centre. The bays of the hall at Great Chatfield are square, as is that of the later example at Stockton House, Wilts. In some, as in the last-mentioned case, as well as at South Wraxhall, Kingston Seymour, Clevedon, and Samlesbury, the bays have rooms over them, and are consequently separated into two stories of height both internally and externally; but the bay window, properly, and more interestingly as a fenestral feature, is of the kind existing, as before mentioned, at Crosby Hall, Eltham, Compton Wingate, and Kiddal.

Of this latter description of bay window, a very fine example remains in the hall of Wingfield Manor House, in Derbyshire, and which, as one in many ways suited to modern uses and application, we have illustrated in detail in *Plate* 20*d*. The date of this window

Fig. I. ELEVATION



SCALE OF THE ELEVATION

0 1 2 3 4 5 10 15

Fig. 2.

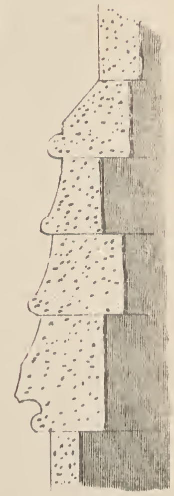


Fig. 3.

Fig. 4.

Fig. 5.

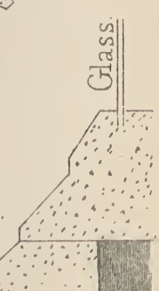


Fig. 6.

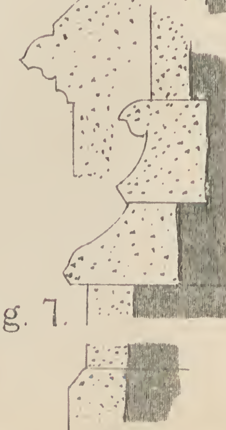


Fig. 7.

D. BRAND. LITH. 10. OLD BAILEY.

is about 1440, or the middle of the fifteenth century, and it exhibits the better and frequent arrangement in houses of the higher class, of a bay running the whole height of the hall, and finishes with a richly panelled and embattled parapet, in continuance of that which crowns the walls of the hall itself. In plan it shews a projection of three faces, buttressed at the salient angles, the centre filled by a window of four lights in two main divisions, one of which divisions forms the lights of the side faces. The arches are four-centred, and the lights are divided in their height in a mode very common in Perpendicular work of the age. There is a good bold window-cill, and the base-mold of the hall wall is continued round the projection of the bay.

Fig. 1, on the *Plate* shews the geometrical elevation of the bay, with contiguous portions of the hall wall, with its parapet and basemold.

Fig. 2, is a section of the coping molding of the parapet.

Fig. 3, a section of the upper tabling of the buttresses.

Fig. 4, is a plan, or horizontal section, of the window-jamb and mullion.

Fig. 5, is a section of the lower tabling of the buttresses.

Fig. 6, a sectional cut through the cill; and

Fig. 7, a vertical section through the base-molding and its plinth.

Of this style of bay window, as before mentioned, there are several remaining examples, some of which have been already noticed. Another kind of bay is also frequently met with, being a projecting window from the upper stories. Some of these are highly expressive evidences of the skill of the ancient masons, both in construction and effect. The plans of these vary in the same manner as those which have been just treated of. Some are canted; some of a semicircular, or other sweep; and some of the rectangular form. The specimen from John of Gaunt's House, at Lincoln, previously referred to, is a bay of the description of those on which we are now about to offer remark. It is, as before said, a portion of an octagon, and is projected or corbelled out, according to the more usual plan in the case of these bays, on a series of moldings, and is worthy of notice as having a very extended projection, and which, in other instances of similar extension, is assisted by additional contrivances for support.

Another very beautiful corbelled bay is to be seen in the south gable of the Vicar's Close, at Wells; and there is another, of simpler kind, in the common hall of the same building. There is another on the right hand of the north front of Great Chatfield Manor-House; but instances might be multiplied to a large extent. Of the rectangular projected bay, there is a very interesting and but little-known specimen in the remains of the monastic buildings attached to Castle Acre Priory, in Norfolk. There is also here a semicircular bay, the corbelled projection of which rests, by way of additional support, according to the practice before noticed as sometimes found, upon arches which spring from the walls to a central buttress, carried up from the ground to the circular base of the sweep or bow. A semicircular bay window at Great Chatfield is assisted in a like manner by a buttress carried up to receive it, the angles formed by it with the wall of the building being filled with a kind of flat groin, which, springing from a curved head on each side, receives the circular projection of the

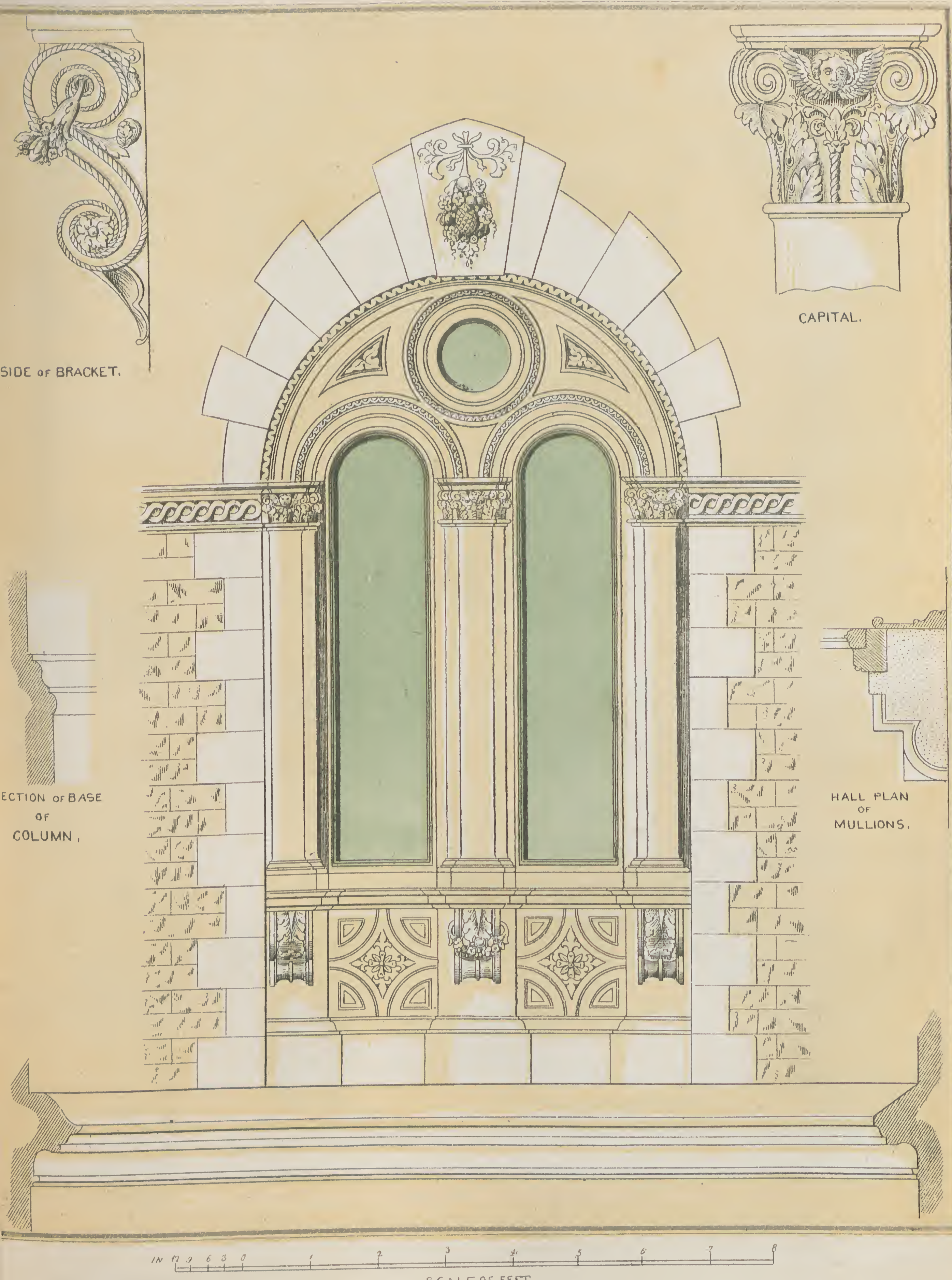
window. Both this bay, and the one previously noticed from the same house, are very effective and well-treated examples of the bay window as projected from an upper story, and the latter is the more curious, with respect to constructive considerations, from being projected immediately over a broad four-light, square-headed window, which lights the room below. There are two small windows in similar fashion under the semicircular bay first mentioned; but they are not so directly in connexion with the groined support or corbelling of the bay above; and the buttress, likewise running up, forms an evident and practically substantial support between them. Like introductions of the projecting oriel or bay over openings of greater or less width, to that above mentioned, occur in many instances. They are frequently met with over gateways. There is a projecting bay window over the second gateway at Hampton Court Palace; and a very pleasing example exists in the gatehouse at South Wraxhall Manor-House. The arch is in this latter case an exceedingly flat four-centred one, within a square head, and the corbelling of the bay issues immediately from the square label above it. It is a semi-octagon in internal plan, three of the facesp roj ecting externally, and isa very curious evidence of the construction indulged in, or ventured on, in these cases.

In the later Perpendicular, and the styles which succeeded, bay windows were often very large and extensively introduced. In some late Tudor, and in the Elizabethan and Jacobean houses, the bay is a feature over and over again repeated, and in almost every variety of plan; their size is also, following the practice with respect to windows generally at this time, usually considerable. Many houses of these periods are, in many cases, little else than a series of windows, in which those of the bay form bear a very large proportion. Harrison, in his "History of England," particularly notices this peculiarity of the Elizabethan and later houses. In the dining-room of Gilling Castle, in Yorkshire, there are two large bays side by side; one a portion of an octagon, the other rectangular. The former projects very considerably; the latter less so. A plan and elevation of the portion of the room in which these bays are situate is given in Shaw's "Elizabethan Architecture."

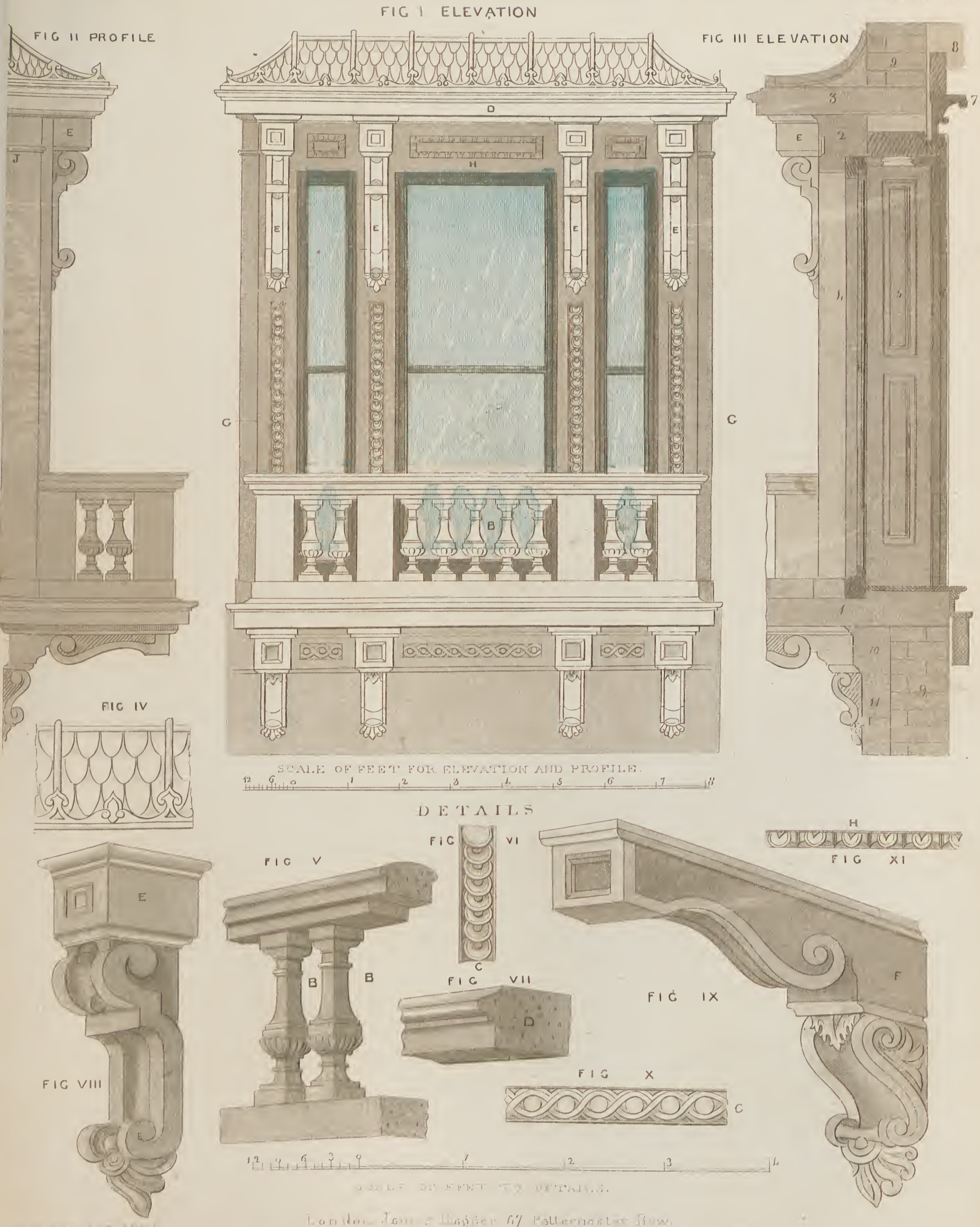
All the windows of this date, with but few exceptions, have simple square-headed lights, the height divided by one or more transoms, and there is no particular constructive skill, and generally but little artistic treatment in them worthy especial notice as far as the present work is concerned. The fronts of Montacute House, in Wilts, also given in "Shaw," exhibit perfectly the character of the windows now under consideration, and the more regular arrangements of the same which appear in some of the larger houses. As before observed, however, there is little, artistically or constructively, to call for further observation, and we will therefore pass to a general view and description of some of the varieties of window which the more modern, and perhaps more generally useful, practice of the present time has introduced.

The revived Italian forms which succeeded the last phases of the Elizabethan and Jacobean have been before disposed of, as well as the later introductions of the Grecian character. The Italian and Classic of the present day, owing their origin to a more extensive examination of foreign adaptations, differ very materially from either, though directly founded thereon. As already noticed, the strict rules of former designs are less observed and

DESIGN FOR A WINDOW.



DESIGN FOR A WINDOW.—ITALIAN STYLE.



London: James Hagger 67 Paternoster Row.

as a consequence, a character less arbitrary in its kind is generally exhibited. Reference to the freer and less conventional treatment seen in many of the larger Italian mansions of the periods which immediately succeeded the revival, is prevalent in a very large number of instances, and in many with very agreeable results. At the epoch in which the buildings here alluded to were constructed, Italy, says a talented author, was covered with mansions, in the construction of which all the best features of the Antique were retained, both as respects mass, detail, and proportion, and to these were joined improved convenience of arrangement, and a plan accommodated to wants and habits more nearly approaching those of modern times. It is this, perhaps, that has advanced the study and introduction of the Italian characteristics. The regularity, or rather accepted uniformity, of the more strictly Classic type has been felt, on many occasions, as a great restriction in the way of the most agreeable or judicious arrangement of interior requirements, and it has likewise affected, to an equal degree, preconceived English notions of diversified and picturesque external appearance. In many Italian examples, these difficulties have been very satisfactorily met, and this course has largely tended to spread the consideration for, and the adoption of, similar methods of treatment.

In *Plate* 21 we give a modern version of a window designed after the Italian models here alluded to. It is, as will be seen, of the arcuated kind, and is treated generally in a manner very commonly to be met with. The intrados or soffit of the main arch, as are those of the two principal lights, is semi-circular; the extrados is slightly pointed, and is rusticated, as are the quoins or angles of the main opening in which the window is formed. These rustics may be constructed in relief, or, if the voussoirs are composed of stones of a different colour the one from the other, the relief might be formed in this way, with very good effect, as is evidenced in several of the Italian palaces and other buildings. The introduction of coloured material might be further extended to the columns and pilasters, which constitute the decoration and filling-in of the central portion of the window. Polished granite, or some of the Devonshire or Irish marbles, would be applicable in this case. The main body of the filling-in, and the moldings and enrichments, should be of free-stone. The capitals of the columns, &c., and the consoles beneath the window-cill, might be of metal,—if in very rich work, bronzed or gilt.

The elevation, and the several details shewn on the Plate, will give all further explanation necessary; and we will therefore proceed to the description of a second example of the modern Italian window, in which, as distinguished from the former, the square or straight-headed principle is adopted.

This second example forms, with its details, the subject of *Plate 22*, and exhibits a window formed of a centre and two narrow side-lights, separated and otherwise enriched with carved pilasters and consoles, supporting a projecting cornice, &c., above, and a balcony below. This window is here proposed to be wholly constructed of stone, as an adjunct to a brick building (see the section, *Fig. 2*), but the design of it might be carried out in brick and cement, when such a proceeding might be considered desirable. In this case—or, indeed, in either—the balcony might be omitted, or shortened of its projection, and the window completed without it altogether, or with such modification of it. The under consoles, in such arrangement, would then simply act as supports to the pilasters,—the same being divested of the

upper portion, which is carried out beneath the balcony bottom. The window is, as before observed, square-headed, and is arranged for the reception of a casement sash, for which, however, the usual sliding sashes might be substituted, if preferred. The interior is shewn as finished with boxing shutters, or framed jambs, and the floor of the window is raised one step above that of the room.

Fig. 1, represents the geometrical elevation of the window, with the balcony and consoles, &c., supporting the same.

Fig. 2, is a like geometrical elevation of the side or profile.

Fig. 3, is a section through the window, shewing the construction and adjustment of the several parts,—such as the stone landing of the balcony, with the consoles and stone ashling in front of the brickwork of the wall below; the stone frieze and covering, or bonding-stone above, with the side of the upper console in connexion therewith (marked E); the brickwork above the window (figured 9); the interior finishings, and the cornice of the ceiling (figured 7).

Of the enlarged details given in the lower part of the Plate,—the letters on which refer to the corresponding ones on the elevations and section,—*Fig.* 4, lettered A, shews a portion of the roof-covering, which may be constructed in metal, as indicated in the section, or, to accord more strictly with the rest of the work, in stone.

Fig. 5 (lettered B), is a perspective representation of the balustrade of the balcony, with its capping and plinth.

Fig. 6 (marked C), shews the ornamentation of the sunk face of the pilasters at large.

Fig. 7 (lettered D), is a sectional cut, in perspective, through the cornice of the window, D, on the elevation, *Fig.* 1.

Fig. 8, is a perspective view of the upper consoles (marked E on the elevations and section).

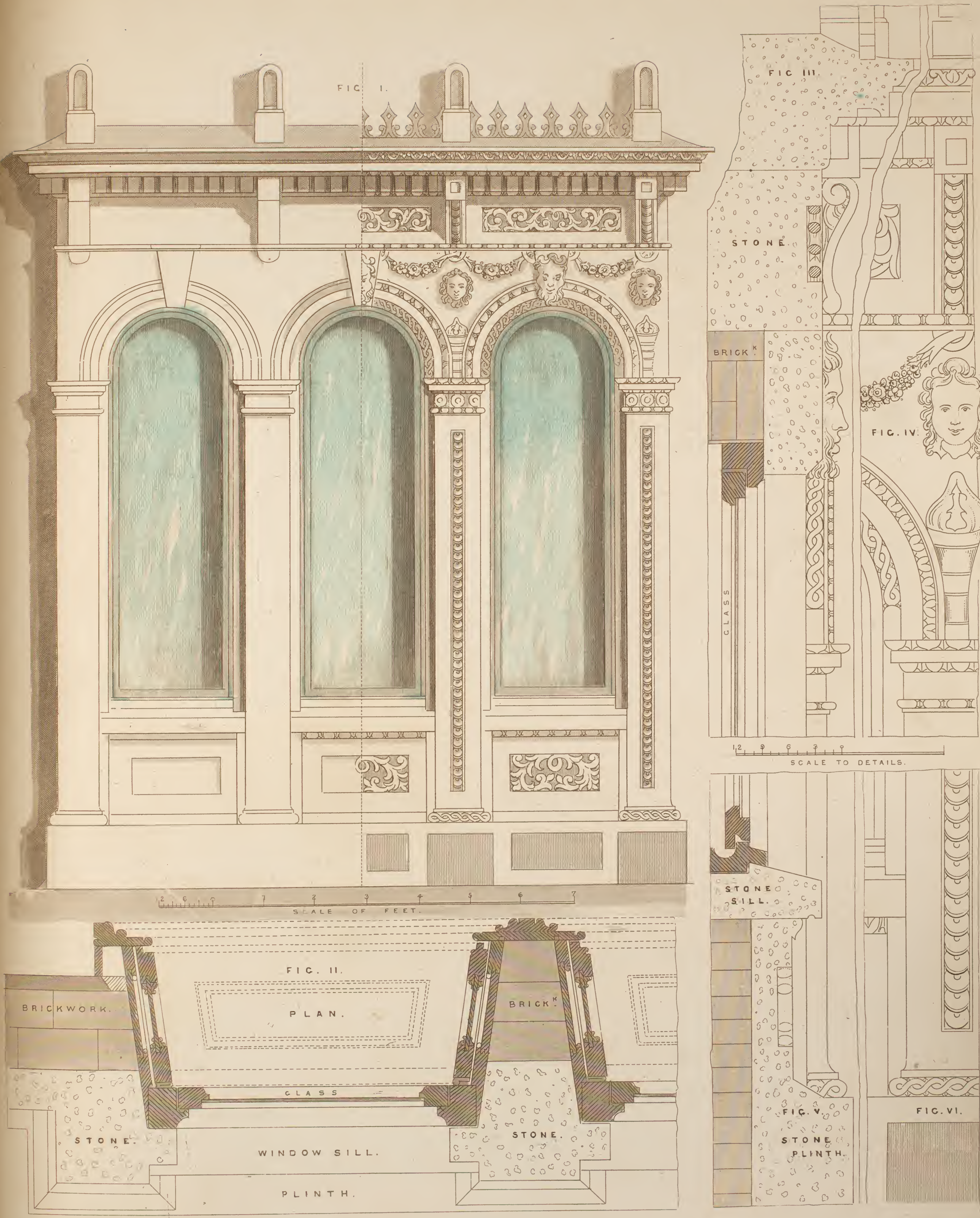
Fig. 9, *F*, is a like perspective view of the lower console, or bracket support of the balcony landing.

Fig. 10, shews the enrichment in the string-course, beneath the balcony, to an enlarged scale; and

Fig. 11, the enriched molding of the panels of the facia, or frieze, forming the window-head, also enlarged.

To the above two forms of the modern Italian window we will, in conclusion of our notice of this part of the subject, add one other of by no means unusual description, and very generally applicable. It is shewn in *Plate* 23, to which we now refer the reader, in two characters, the one plain and the other enriched, the main form and arrangement being the same in each,—that is to say, that of a window of three arch-headed lights, separated by pilasters, and carrying a denticulated cornice and consoles. The main projection, as will be seen, is simply that of the square of the pilasters, the plinths of the same being a return of that of the building, presuming the window to be on a lower story, or of a string, in the case of its being placed in an upper story, when small brackets or blocks would be required, to aid in, and give the necessary appearance of support.

ELEVATION AND DETAILS OF A WINDOW.—ITALIAN STYLE.



S. H. BROOKS ARCT.

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Fig. 1, is the elevation of the window, as before observed, in two kinds,—that on the left plain, and without further adornment than the lines of the composition afford; that on the right with the moldings and surfaces filled with ornament.

Fig. 2, exhibits a portion of the plan of the window, in either case, to an enlarged scale, shewing the connexion of the brick and stone-work, and the internal finishings of the window, with its frame and casement, and its shutter, &c.

Fig. 3, is a vertical section through the upper part of the window, giving the outline of the cornice and frieze, and shewing the discharging arch over the head of the window-frame, with the side view or profile of the carved keystone, the arch-moldings, and the pilaster cap, &c.

Fig. 4, gives an elevation of a portion of the upper part, taken over the pilaster, shewing the ornament in the spandrels of the arches, and the face of the enriched console, and other members of the cornice above.

Fig. 5, is a vertical section, similar to *Fig.* 3, through the lower part of the window, shewing the bottom rail of the casement, and the contrivance in that and the cill of the frame to exclude the passage of wet, and for the reception of internal condensation, with the profile of the stone cill and plinth, and the intermediate dado, with its sunk panel, and the connexion of these latter with the brickwork of the wall.

Fig. 6, is the elevation of a portion of the same lower part, shewing the base of the pilaster, its enriched torus, and the ornament on its face, &c.

The scale of these enlarged details,—that is to say, of *Figs.* 2, 3, 4, 5, and 6, is twice the size of the elevation figured 1.

CHAPTER XIII.

WALL-ARCADES, COLONNADES, ETC.

Of Arcades, or continuous ranges of arches, there are several examples in classical antiquity, particularly in the remains of ancient theatres. In those of the Theatre of Marcelius, at Rome, there still exists evidences of a range of arches of considerable extent; and they occur also in the Coliseum, and other instances. It is from these sources,—and particularly from the first-mentioned example,—says a modern author, " that the architects of the 16th century derived the idea and proportions for both the interior and exterior arcades of most of the great palaces of modern Italy." In these instances, this employment of arcades, considered as galleries, is

almost universal. "Rome," continues the same author, "presents many examples." The courts of the Vatican, those of Monte Cavallo and of the Borghese, and many others, are surrounded with arcades. In some modern Italian towns, the streets are lined on each side with arcades, of which we have an imitation in those of Covent Garden. As a street feature here, however, they are seldom used, though they are sometimes introduced in the interior of English buildings, to form corridors, but on a small scale compared with their Italian prototypes. It is these latter that offer the most extensive, and, at the same time, the finest evidences, and the greatest variety in the applications of the practice. The general arrangement followed is that of a series of arches, extending in height one story of the attached building, springing from, or reposing on, a single column or a pier, forming, round the cortiles or courts, a covered walk, which serves also as a means of sheltered communication with the different apartments. Sometimes the arches are supported by two columns, placed under the impost, instead of a pier or single column. This is the arrangement in the court of the Borghese Palace, in which, as in other instances, there are two ranges of arcades and columns, one over the other. Of this kind "was originally the immense interior of the court of the Vatican, by Bramante, the apertures of which were afterwards obliged to be filled, to remedy the lightness of the construction;" and "such is also the beautiful court of the Palace of the Cancellaria, by the same architect, which is composed of arcades of greater elegance, supported by columns of marble." Further variety occurs in the Loggia of the Vatican, by Raphael, where the arcade "consists of three ranges of open galleries, the one above the other."

In examples of less importance, arcades are often constructed without columns, and are, in this shape, particularly suitable for edifices in which simplicity with strength are to be combined, or for the exterior of buildings forming public squares or market-places, &c.; for it has been remarked, that "a series of arched openings," such as arcades are, "though not so magnificent as a range of lintelled apertures, is more solid, stronger, and less expensive" than are colonnades, and, for this reason, can be more advantageously employed in such situations, or, indeed, in all where wide spaces are desirable. Arcades, however, "submitted to the proportions of, and decorated with, the several orders of architecture, as employed in the exterior of edifices," are very general,—indeed, this is the form in which they are more commonly found in the buildings, both public and private, of the Italians.

"The proportions of arcades, decorated with orders of architecture, vary according to the order employed, which determines the dimensions, forms, and taste. In the Tuscan, which the moderns have distinguished from the Doric by a greater appearance of simplicity, the arcade has no archivolt, and but a simple band for an impost. The same order, with a pedestal, has an architrave and impost, less simple than that without pedestal, which is the case with all the arcades of Vignola.

"The Doric arcade is ornamented with an archivolt of two facias, crowned with a few moldings: the same moldings are used in the impost.

"The Ionic arcade has ornaments less simple than those of the Doric, and is further distinguished by a keystone [usually] in form of a console.

"The Corinthian and Composite arcades have their archivolts and imposts still more ornamented;" and "the proportions of all are determined, as regards their heights, by those of the columns which are applied to them."

The above observations are extracted from Billington's "Architectural Director." Another author, quoted in Stuart's "Dictionary of Architecture," adds, speaking of their general importance, that "the void or aperture of the arcade should never be more in height, nor much less than double its width. The breadth of the pier should seldom exceed two-thirds, nor be less than one-third of the width of the arch, according to the character of the composition; and the piers at the angles should be broader than the next [others] by one-half, one-third, or one-fourth."

"The thickness of the piers," he continues, "depends on the width of the portico (or part enclosed), and the weight which the arcade has to carry above, for they must be strong enough to bear the burden and to resist the pressure of the vault of the portico."

When the arches of the arcade cease to be open, and are closed up to receive doors, windows, or niches, as sometimes happens, the recesses, according to Sir William Chambers, the authority quoted in the work just referred to, "should be deep enough at least to contain the most prominent parts of what is placed in them; otherwise the style of architecture will appear flat, and the cornices of the niches, or windows, projecting before the fronts of the arcades, will become too powerful and striking in the composition."

To the directions of this author on arcades, here noticed, there are other observations, also quoted in the work just mentioned, so valuable and suggestive, as respects the treatment of them generally in relation to the decoration, or other beauty, of the building in which they are employed, that we cannot refrain from making further extract, the more so as the authority is allowed to be one of the best that can be referred to, and, at the same time, supplies a very full and useful exposition of correct practice on the point.

After noticing several ways in which the interior area, formed by an arcade, may be properly and effectively constructed and finished, according as it may have a vaulted or a flat ceiling, all more or less deserving attention, he proceeds with reference to the exterior to say as follows:—

"There are various modes of decorating an arcade externally; sometimes the pier is rusticated, at others a pilaster is placed on it, or a column, or a terminus, or caryatides; and, on some occasions, the piers are made broad enough to admit a niche or a window.

"The circular part of the aperture is either surrounded with rustic arch stones, or with an archivolt enriched with moldings, which, in the centre, is generally interrupted by a key-stone in the form of a console, a mask, or some other proper ornament of sculpture, serving at the same time as a key to the arch, and as a seemingly necessary support to the architrave of the order. Sometimes the archivolt springs from an impost placed at the top of the pier, and at others from columns, with a regular entablature or architrave cornice placed on each side of the arch; and there are some instances of arcades without any piers, the arch of their ceiling springing from single or coupled columns, sometimes with and sometimes without entablatures,

as in the temple of Faunus, at Rome, a practice seldom to be imitated, being neither solid nor handsome.*

' When the arched openings are wide, the key-stone should never be omitted, but cut into the form of a console, and carried close up under the soffit of the architrave, which, by reason of its extraordinary length of bearing, requires a support in the middle. And if the columns which adorn the piers are detached, as in the triumphal arches at Rome, it is necessary to break the entablature over them, making its projection, in the interval, no more than if there were no columns at all; for, though the architrave might be made sufficiently solid, yet it would be disagreeable to see so great a length of entablature hanging in the air without any prop or apparent support.

" It is, however, to be remembered that these breaks in entablatures should be very sparingly employed, never, indeed, but to avoid some considerable inconvenience or deformity, for they are unnatural, render the columns, or other supports, apparently useless, destroy, in a great measure, the simplicity of the composition, and can seldom be contrived without some mutilations, or striking irregularities in the capitals."

The remarks here made on this point cannot be too forcibly impressed upon the mind. The column is essentially a feature of support, and any application of it which nullifies this idea, or conveys the impression that it is employed without serving such purpose, is a falsification of its true and legitimate use. For this reason engaged columns are, in a measure, objectionable, and pilasters on the face wholly so. In the best periods of Classic architecture the latter were never so used, the same taking simply the form of antæ at the angles, and the best and most correct introduction of either are where they appear in their primitive capacity of isolated props to a superimposed construction, or regular and continuous independent entablature. But to return to the author under quotation.

"The imposts of arches should never be omitted unless platbands supply their place. In all arcades the arches must not spring immediately from the impost, but take their rise at such a distance above it as may be necessary to have the whole curve seen at the proper point of view. When archivolts are employed without a key, or a console in their middle, the same distance must be preserved between the top of the archivolt and the architrave of the order (if one is used) as when there is a key, cr at least half that distance; for when they are close to each other their junction forms an acute and disagreeable angle."

The above observations comprise nearly all that need here be said as regards the general

* It will be seen from this observation that Chambers discountenances arcades formed without the intervention of the pier. According to the regular and stricter rules of revived Classic architecture, he would have, probably, sufficient authority for this. He has, however, to an extent, departed from such limitation in his interior arcade forming the entrance to Somerset House; and in several of the earlier and otherwise consonant Italian specimens arcades are constructed in the fashion of the text with acknowleged success in effect. In those which include the Gothic element, such or similar arrangements are very prevalent, and have been received with little question.

description and distributions of the Classic arcades. With them, as with all other features of ancient architecture, and that founded thereon, there exist numerous differences and variations in the minor points, and, on the score of the proportions in the detail employed, almost all the great architect revivers of Classic differ from each other in these respects; and there are like variations in the ancient remains from which they have derived their theories. Numerous works exist in which all these are entered into in detail, so that it will be unnecessary here to reproduce them. They are matters not absolutely essential to the correct understanding of the general directions and principles which we have endeavoured to explain, or to the production of similar works which, based on the latter, would meet all the requirements of practically good and artistically correct architecture. The great element in either case is the general proportion, and the due relation and disposition of the mass and void. These determined on, and arranged upon the established principles of taste, are the points which deserve and should command the first attention. It is the view of this, rather than the consideration of the minuter detail, that is the grand source of the pleasurable emotion raised by the contemplation of the works of all the great Classic architects, both ancient and modern. The relative proportion and proper study of the latter is, of course, by no means to be disregarded; but it is upon the due observance of the rules which regulate the former, more particularly, that the results of architectural composition are good or bad in effect. The architects of the Revival were fully alive to this, and founding upon and deducing their practice from the ancient sources, which evidence an equal if not a fuller consideration of the point, have left us, in the way both of precept and example, all that is requisite to the attainment of a like success with them in this respect.

It may not be amiss, with a view to the education or association of the eye with the latter, and in aid of the verbal elucidation which we have endeavoured to give of the former, to exhibit together, or in connected representation, a few of the generally received canons as respects the particular subject in treaty. It is true that such have been separately, as well as otherwise, frequently presented and held up to notice, and as often slavishly copied in consequence; but this is no reason why, for the purposes here sought, the continued observation of them should be rejected. By frequent sight of that which is acknowledged to be in proportion correct and beautiful in form, the eye becomes more and more acquainted with the true principles which produce such results, and less and less satisfied with productions which are wanting in the exhibition of them. This alone should be sufficient excuse for what might possibly by some be looked upon as only reproductions of old and already known objects and forms. Good purpose may, nevertheless, be served thereby, for "a thing of beauty is a joy for ever," and the results of a constant reference to, and examination of it, are far more influential than at first sight appears. Artists and artizans generally are too little awake to this, and are often too readily led away to study novelties of introduction, whether really possessing such character or not, in preference to the fundamental recommendations possessed by more carefully produced and considered exhibitions of architectural skill. Not that in these observations we would be understood as advocating no movement beyond the repetition of scholastic forms, and the adherence to the limitations

usually imposed by the earlier teachers of Classic. We have before abrogated this, and simply here contend for a proper and primary consideration of first principles, and the accurate general proportion so generally observable in all their works.

The two authors, to whose productions we shall specially refer as illustrations, are Vignola and Palladio. It is observed of those of the former that they may on all occasions "serve as guides for elegance and solidity. They are devoid of all fantasticalness and caprice, being the result of a fertile imagination and a sound judgment, which qualities distinguished Vignola as one of those who contributed most towards the regeneration of architecture." "It will be seen, on consulting the preface to his work (" *Gli Ordini di Architettura* ") that Vignola studied rather the spirit manifested in the whole of the antique remains, than confined himself to a detailed imitation of any one in particular. In each of his orders, Vignola observed the antique examples which were generally reputed as the most beautiful. He remarked that they all owe their reputation to simple relations easily distinguished, which render the lesser parts dependant on the greater." Wishing, for example, to establish the proportions of the Doric order, "I have observed," says he, "that the Doric of the Theatre of Marcellus was the most esteemed. I have, therefore, taken it for the principal rule of the essential parts of my Doric; but when I found that any lesser member departed from the division prescribed by the ordinance in general (which often happens, either from the inaccuracy of execution, or other reasons), instead of renouncing the fundamental base, which I had adopted, I sought to establish the proportion of these lesser parts; not after any system of my own, but from other Doric monuments of antiquity equally esteemed, and in which these parts had not received the same alteration. I have always made choice of the antique orders, and, on my part, have only given the distribution of the proportions founded on simple relations, without employing measures in feet or palms of any country, but solely an arbitary measure taken from the order itself, named module, and divided into a certain number of equal parts." Beyond this, it has been remarked that, in general arrangements, "Vignola never departed from great proportions, such as halves, thirds, or fourths, the observance of which, in fact, constitutes the principle of that beauty so much admired in his productions." The principle works of Vignola were—at Bologna, the facade of St. Petronio; Iosolani House, and Casa di Achille Bocchi. At Piacenza, the Ducal Palace. At Assissi, the Churches di Mazzano, di Sant 'Oreste, and della Madonna degli Angeli. At Perugia, the Church of St. Francesco. At Florence, the Firenze House. At Rome, and its neighbourhood, the Villa Giulio; the Church of St. Andrea di Ponte Molle; the Caprarola Palace; the doors and windows and interior arcades of the Farnese Palace; doors, &c., of the Cancellaria Palace, and of San Lorenzo e Damaso; the front of the Orti Farnese; the Porta del Popolo; and the Church del Gesu. From these, as represented in his work on the orders before mentioned, we have already given in *Plates* 11*b* and 11*c*, when treating on doors, the door of the Farnese Palace, and that of the Church of San Lorenzo. In *Plates* 24 and 24*a* we shall commence, by adding from the same source, the Doric, Ionic, and Corinthian arcades, according to the proportions affixed and in the manner usually employed by him.

In the first of these *Plates*, viz. 24, *Figs.* 1 and 2 represent the Doric arcade as proportioned respectively with and without the pedestal.

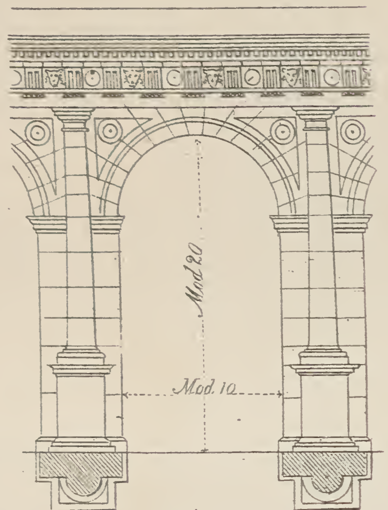

Fig. 1.

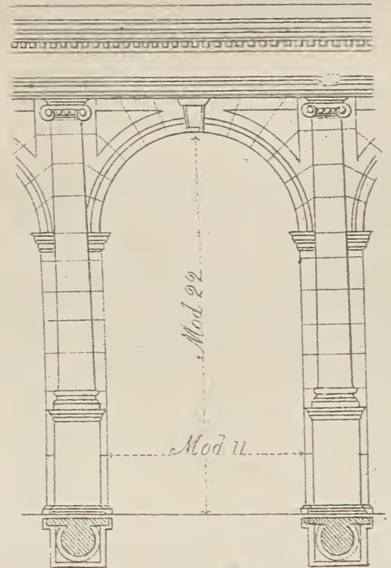

Fig. 3.

Fig. 5.

Fig. 2.

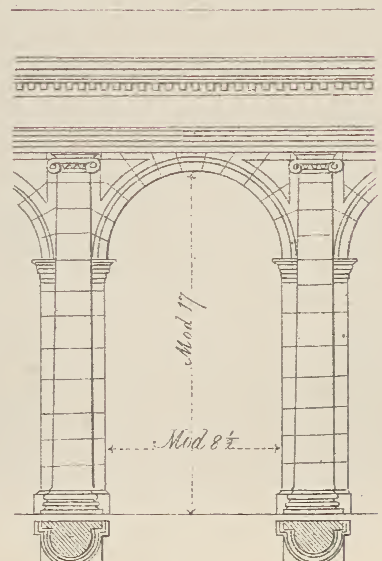

Fig. 4.

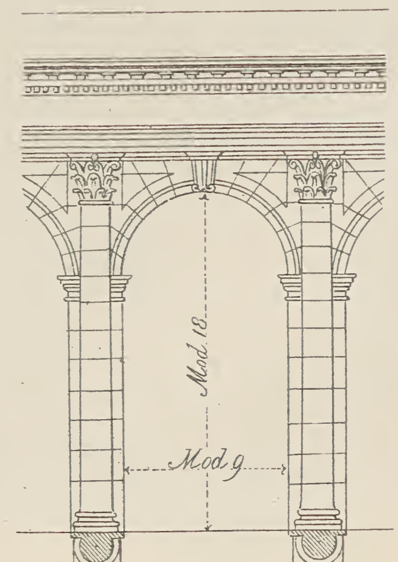

Fig. 6.

London James Hagger 67 Paternoster Row.

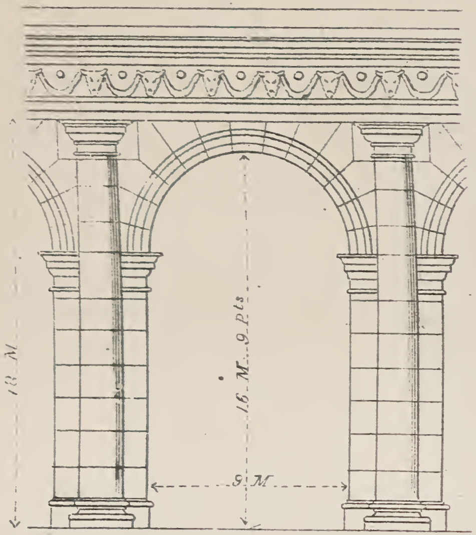

Fig. 1.

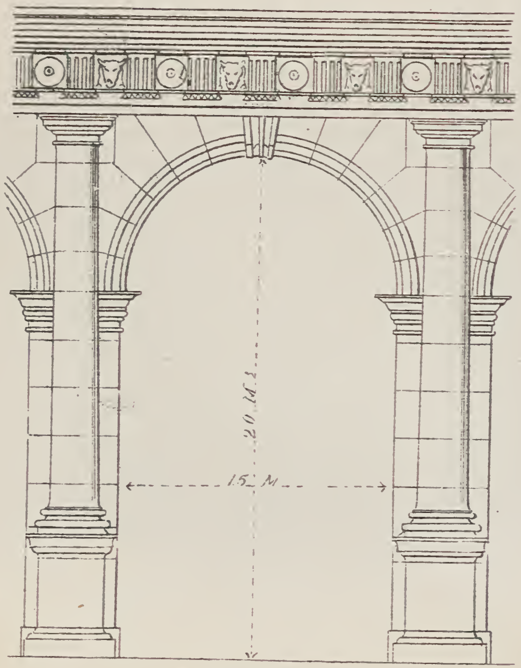

Fig. 2.

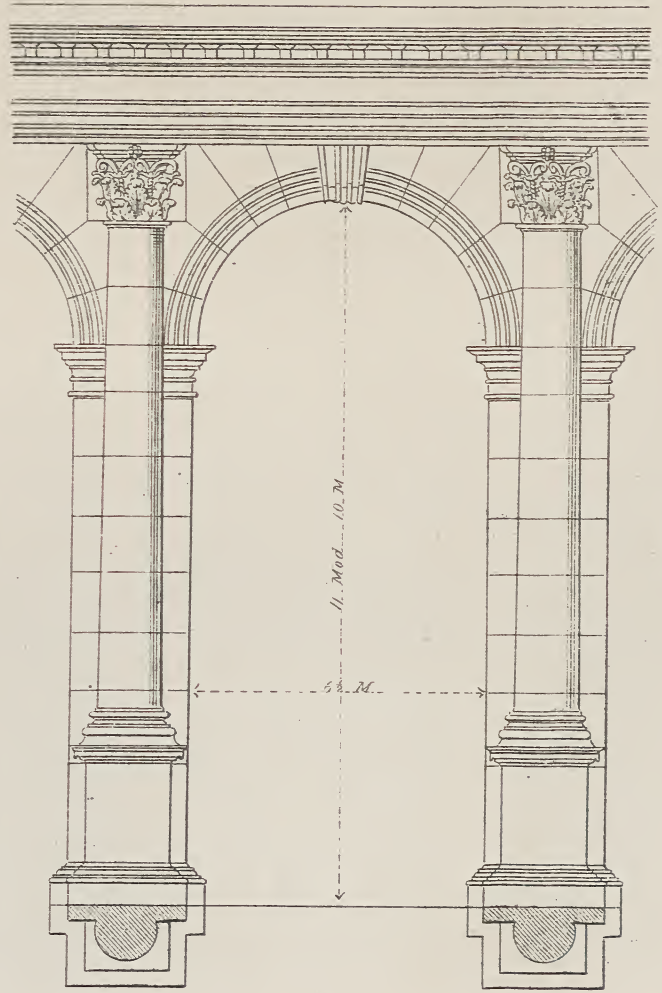

Fig. 5.

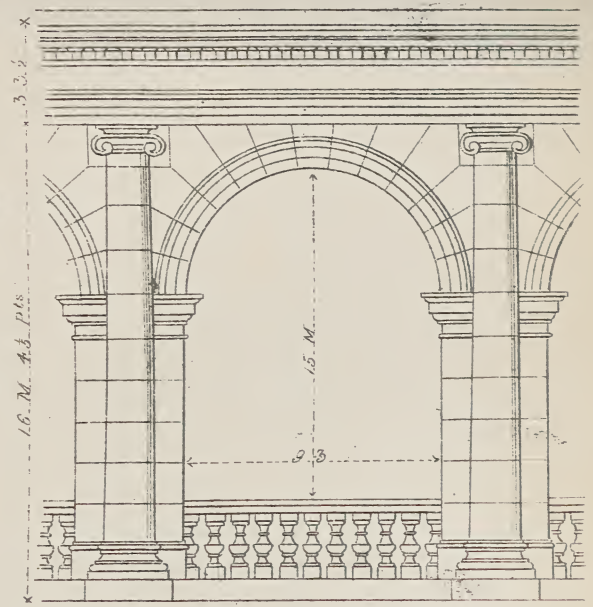

Fig. 3.

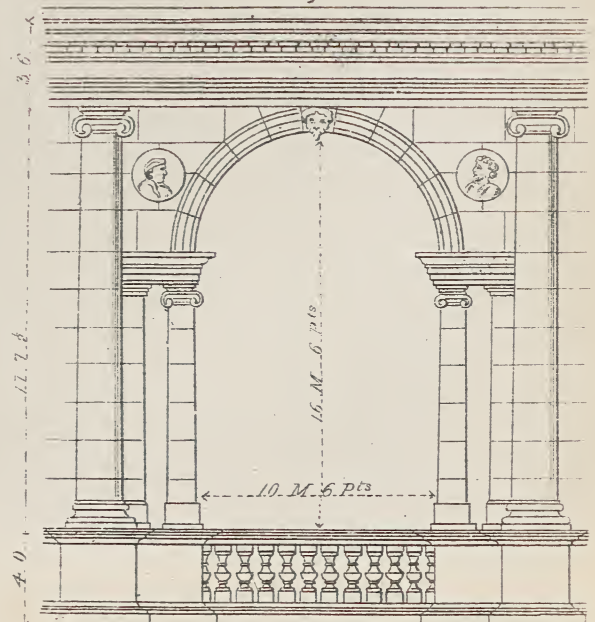

Fig. 4.

Figs. 3 and 4, the Ionic arcade, and

Figs. 5 and 6, the Corinthian, each with and without the pedestal, as in the case of the two former.

In the second, or *Plate 24a,*

Figs. 1 and 2, 3 and 4, and 5, in like manner, exhibit the Doric, Ionic, and Corinthian arcades, respectively, of Palladio, to whom we previously referred. The first, or *Fig.* 1, is from the lower story of the atrium of the Monastery Della Carita, given in his second book, and shews the first-mentioned order without its pedestal, and divested of the tryglyph usually accompanying it.

Fig. 2, is the Palladian Doric, with the pedestal and tryglyph.

Fig. 3, is the Ionic arcade, forming the second story or range of arches, also of the monastery of Della Carita; shewing the Ionic arcade without the pedestal, though filled with a balustrade.

Fig. 4, is the Ionic of the upper arcade, or portico of the Basilica of Vicenza, given by Palladio in his third book, shewing a very pleasing and thoroughly Italian application of this order, with the pedestal included; and

Fig. 5, is the Corinthian arcade of his first book.

To these, as well as to all other works of this master, observation and study cannot be too fully and generally extended, since it has been remarked that "it appears to have been his object to shew that the principles of beauty and design, exhibited in the antique edifices, are suitable to all periods and to all European countries, with the modifications that the ancients themselves have admitted in their works. From his manner of imitating them, he seems to have had no other system than that of making such a judicious application of their principles as they themselves would have made had they exercised their art among the moderns. Thence the free, easy, and elegant application of the masses, lines, plans, and ornaments, in all his constructions."

The conclusions here drawn are fully confirmed on an examination of his numerous works; among the principal of which, as more particularly evidencing the correctness of them, may be enumerated the Basilica of Vicenza, from which we have just given example; the houses Valmarana, Trissini, and di Porti,* with others in the Vicentine; the Monastery of the Canonici della Carita, from which we have also taken illustration; the Refectory and Church of that of San Giorgio Maggiore; the Church of San Francesco della Vigna; the Olympic Theatre, and Il Redentore, at Venice. Other buildings, at Rome, Verona, and other places, might also be enumerated.

Having thus far pointed out the correct and authorised principles, and the best models for study, as regards the Classic arcade in its revived form, it may not be unnecessary, perhaps, to add a few words in reference to those which regulate the colonnades of the same as well as the earlier and more strictly Classic periods, from the consideration of which we will after-

* All these buildings are illustrated by plan and elevation in Palladio's principal work on architecture, as are those also of Thiene, Foscari, and several others.

wards proceed to similar elucidation as applied to the case of the arcades of the Gothic age, so fertile in the introduction and example of this latter feature.

The Classical colonnades are, for the most part, simply a series of columns, supporting a superincumbent structure, more or less weighty, by very simple means as respects constructive ingenuity. The ancients, obtaining readily large and lengthy blocks of stone, had no necessity but to choose such as were suitable in these respects to the intercolumniation adopted. Their entablatures, or at least the lower division of them, or the architraves, are usually of one piece, extending from axis to axis of the columns supporting them ; though, in some of the later Roman works, there are instances of a departure from this practice, forced upon them, probably, from failure in the supply of sufficiently large material; or originating, perhaps, in an attempt to gain the same end at less cost than must necessarily have been incurred in the transmission and erection of blocks of stone of the size usually seen, and in the greater number of cases previously employed. One curious example of this is noticed in Perrault's translation of Vitruvius, as contained in an ancient building formerly existing at Bordeaux. The columns of this building were, it is stated, 4 feet 6 inches in diameter, and the intercolumniation, or distance between the columns, was 7 feet. They were constructed of courses of hard stone, about two feet in height each, laid without mortar or lead, the jointing being almost imperceptible ; and above each column was placed a large block of stone, in position to support between them a corresponding wedge-shaped piece, or key-stone, which with them completed the architrave ; forming practically a straight arch, or plat-band, of three pieces. It is in modern work, however, that contrivances of this kind have been more largely rendered necessary and entered into, as we shall have occasion presently to notice.

Historically, and as to date, the colonnade is much anterior to the arcade. The Egyptians made very frequent use of colonnades, some of their temples being literally thick-set with them, both within and without. The Greeks also largely indulged in the adoption of the colonnade, using them more commonly as porticos and peristyles. To those of Roman times there are numerous references and descriptions to be gathered, both from ancient and modern Classic authority. Vitruvius gives rules for columnar arrangements of the kind, and distinguishes by accordant terms, the various applications as regards disposition and number of the composing columns ; and it is upon these rules that modern practice is, for the most part, founded—in the case of porticos, and such like introductions, more particularly. It will be hardly necessary to enter into a detailed notice of all these, since practical questions for the consideration of the mason are not therein involved, and the necessities of modern practice entail non-adherence to the ancient regulations to a very large extent. With respect, therefore, to the proper proportion or disposition of columns in colonnades, it has been correctly observed, " that the only principle of taste that can be advanced, as regards intercolumniation in these cases, is that which is governed by the effects which ought to characterise the composition in which the columns are employed." This principle is the less restricted in its application at the present day, perhaps, from the fact that we have not to deal altogether with the considerations to which the more ancient builders of colonnades, when building with stone, were confined. With them, the pychnostyle, or thick-set disposition,

cases, taken to be a necessity fixed by the length of the blocks of which the architraves were to be composed. With us, dealing with material of different capacity or kind, and requiring an altered and more complicated arrangement to obtain constructively similar appearances and end, the same limitation does not practically exist. We can indulge in a width of intercolumniation, if necessary, to which the most open of theirs, the arœostyle, does not extend. In modern practice and adoption of the more strictly Classic idea this denotes the intercolumnar space of four diameters; but, among the earlier revivers, difference of opinion appears to have existed as to its extent. Vitruvius does not determine its precise measure, and several of his commentators have endeavoured to supply the omission. "Following the same progression observed in the other intervals, which increase each a semi-diameter, the arœostyle should be equal to three and a half diameters. Perrault, in his translation of Vitruvius, proposes that the interval be made equal to four diameters. Another author thinks that Vitruvius alluded to a much wider space than even that assigned by Perrault, and he makes it five diameters." In the face of this disagreement and uncertainty, it may be well to have reference to the principle which has been before enunciated, and regulate procedure according as it may satisfy the same, and the requirement of the purposes sought.

Of the ancient colonnades, viewed as peristyles, or enclosures of a similar kind to arcades, there are no extended remains. Many of the Revived, and of a later period, however, yet exist. The most celebrated, and at the same time most extensive, are the colonnades of the Vatican. "This magnificent colonnade, the work of Bernini, consists of two hundred and eighty columns and forty-eight pilasters, of forty feet high, raised on three lofty steps, and surmounted by a balustrade, on which are eighty-eight colossal statues of saints, fifteen feet high." There are also some good examples on a lesser scale among the Italian palaces; and the colonnades of the Louvre, and one or two other buildings in France, afford other interesting evidences. In England examples are not numerous. There is a small colonnade at Hampton Court Palace of very effective proportion and appearance. The colonnade at Burlington House, London, is also deserving of especial notice, and there are others in some of the larger mansions, erected in the last century, in more distant parts of the country.

In the construction of most of the arcades of modern times, following the prevailing practice of antiquity, the most simple means have been employed, such features being, for the most part, arranged in the composition to accord with the nature and capability of the stone, or other material employed, and their proportions correspondingly regulated. The limited size of most modern erections of this kind, compared with ancient example, has rendered this proceeding the more easy. In some cases, however, it has been found necessary, from the increased proportion, and more considerable character of the edifices erected, to have recourse to constructive contrivances, which should, in the absence of facilities for, or the power of obtaining, the large and single masses of material anciently used, supply the place and stand in the stead of the same. It has been before noticed (see page 142) that, in the case of an ancient building at Bordeaux, now demolished, the architraves were formed of more than one piece of stone, contrary to the method most usually found. A corresponding arrangement, the first idea of which was possibly derived from the observation of the principle here, occurs

in the peristyle of the Louvre, and forms a comparatively early example of the use of such practices in modern Classic works. The intercolumniations in this instance are of considerable extent, the superior,—for the arrangement is that which has been denominated arœosystyle, or that of coupled columns,—being 15 feet 5 inches from axis to axis of the column, and 11 feet clear at their bases, the latter being 3 feet 7 diameter. For this great length stone in one piece was, doubtless, unattainable; the straight-arch principle, as in the instance at Bordeaux, amplified, was therefore adopted. On reference to *Plate* 7*b*, it will be seen how the construction of the architrave, and its superimposed frieze, was in this case contrived, and, with the assistance of the iron cramping and ties inserted in aid, executed; and the woodcut, which we introduce below, *Fig.* 1, gives the effect of it viewed externally.

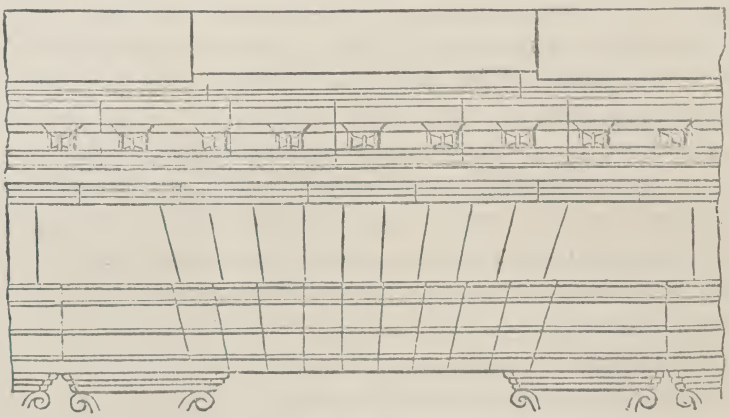

Fig. 1.

Another example, following that of Perrault, just given, of the same method of treatment, occurs in the colonnades of the Place Louis XV., by Gabriel. In this case, the distance from axis to axis is over 12 feet, the columnar arrangement being single. The architrave and frieze is here, as in the Louvre, formed of a number of wedge-shaped stones—breaking joint with each other—every alternate one of the architrave rising into the frieze, exhibiting nothing more, in fact, than the principle and form of the straight arch, still common in brick construction. We give in *Fig.* 2, in the following page, the elevation of the entablature of this example, from which the entire arrangement will be more clearly seen, having already, in *Plate* 7*a*, shewn the similar construction, internal, and otherwise, of the transverse architraves and plat-bands of this structure.

In looking at these two examples of the modern modes of construction, employed in the cases and under the circumstances alluded to, it will be seen that there is no attempt to conceal the constructive means by which the architrave and its frieze is made to cross the space intended. No desire is exhibited to give an appearance which the component particles, forming the whole, do not sanction. There is no wish, apparently, to create the impression that a single block forms the architrave, under the fact generally known and understood

that such is unattainable, or might, otherwise, be unadvisable for the purpose. This is a great point in architecture, which should not deal in false appearances or pretences. A great, or permanent success is not attained by untruthfulness, and the axiom is of architectural as well as of other application,—a fact which appears not always to be sufficiently remembered, as

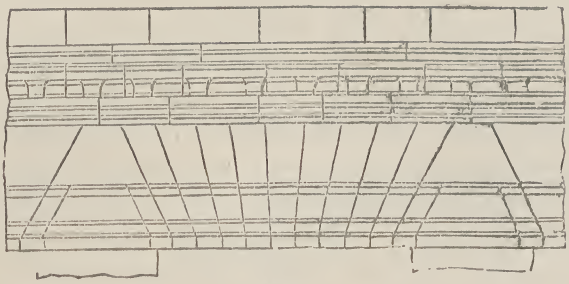

Fig. 2.

might be largely exemplified were many of the constructive contrivances employed in modern architecture brought under consideration. To enter into this, however, would be profitable only to the extent of shewing how far the disregard of the latter maxim has led in, unfortunately, too many cases. A better purpose will be answered by urging upon all interested in the proper development of architecture, both with respect to its constructive and expressive character, to adhere strenuously to that rule which admits only of the undisguised use of the materials at hand, according as they may be fitting and proper. In the question of stone construction, there is no more reason why we should seek to give a feature or part, necessarily formed of a number of pieces, the appearance of one, than that, in a parallel case of brick formation, we should similarly disguise the real nature of the composition in this latter material. Proper expression, and that which is essentially good in architecture, has intimate relation to the adoption of the material at command, in the manner best suited to the purposes required, in its natural form and in a measure as it comes to hand. It is the due consideration and the constant appearance of this in mediæval architecture generally, that constitutes one of its greatest and most enduring charms. There is here seldom, if ever, any attempt to falsify the manner in which the end sought has been constructively obtained. This is forcibly shewn in the case of the horizontal coverings of some of the early chimney and other openings, as at Boothby-Pagnel Manor House; Coningsboro' and Edlingham Castles; &c., &c. In all these instances the constructive principle is the same as that just now noticed as followed by Perrault and Gabriel in the colonnades of the Louvre and the Place Louis XV., and the mode adopted in the formation, with all its jointings, is left perfectly undisguised.

Referring to mediæval architecture, we now proceed to the notice of the arcades of this period. These appear in all the varieties which the different styles of their respective times

originated. Abroad, adopting the idea from the Classic times, the arcade takes now the character of its original, and appears frequently as a covered walk or ambulatory. This is the case in several of the continental monasteries. The cloister of that of St. Antonio at Padua is an arcade of pointed arches, supported on single columns, resting on a low wall or basement. Those of Mont St. Michel are similar. Many Byzantine arcades are also so supported, and were similarly appropriated. In the Church of St. Clement, at Rome, the atrium has arcades on two of its sides, or those parallel to the front of the Church, and colonnades on the two others. Later, and more generally, the arcade, both in foreign and English mediæval architecture, appears as a wall decoration, distinguishing such, of course, from those arcaded arrangements of similar kind which separate the naves and aisles and other main divisions of edifices. The east end of Lucca Cathedral has, externally, a fine wall arcade forming the upper story of its apse. At Pisa, the whole south side of the Capella della Spina is a continuous arcade, or series of canopied niches containing statues. Bernieres, in France, has some fine Norman and what we call Early English arcades; and Amiens has a magnificent example above the west porches. Internally, churches and other buildings, particularly ecclesiastical, are full of them, of a date from the earliest to the latest period. Those of Strasbourg and Freiburg Cathedrals are particularly fine, and there is an exquisite arcade in the Sainte Chapelle at Paris.

In England, wall-arcades comprise, principally, the Norman, Early English, and Decorated: Perpendicular wall-arcades are not so generally prevalent as either of the former. Some of the earliest of the first-mentioned are to be found at Colchester, St. Alban's, and Canterbury, and other examples exist in instances too numerous to particularise. The first specimens exhibit usually a series of intersecting arches. This is the case at Colchester; Christ Church, Oxford; Devizes; and at Canterbury in extreme profusion. Later, ranges of distinct arches are the common forms; and in this shape these are a constant feature of the Norman era. At first the arches bear a very insignificant proportion to the columns supporting them, as is the case with the larger columns and arches which constitute the main architectural divisions of the time. A good example of this exists in the belfry of Christ Church, Oxford, given in the *Oxford Glossary, Plate* 5, and the like occurs in several of the Norman circular towers of the eastern counties, as well as elsewhere. Afterwards the proportions were relatively more in accordance. There is a very good Norman pointed arcade of such a kind at Romsey Abbey Church, and also at Canterbury; and in the transitional period there are several examples in which this improved character is more particularly apparent. Abroad there are many Norman arcades well treated in this respect.

Some of the Norman arcading at St. Alban's, and at Colchester and other places, is constructed in brick, or what was anciently called wall-tiles—the "wah teagles" of the Saxons; but, in general, the superior material, stone, is used. The construction is usually carried out according to that employed in ordinary and the larger arches, with stones formed to radiate to one or more common centres. Occasionally a different mode is observed, applying for the most part, however, to the cases where, as before noticed, the arches over the columns are of so diminutive a size as to allow of their being formed from one stone, which is the case in those of the belfry at Christ Church, Oxford, to which we have just referred.


ELEVATION. Fig. 1.
ELEVATION. Fig. 4.
Fig. 2.
D
A B
C
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 3.
PLAN. Fig. 1.
PLAN Fig. 4.
SCALE OF THE ELEVATIONS

The Norman arcade, in common with Norman architecture generally, is comparatively ill-suited to the uses of modern times, in which economy in the expenditure of material is considered to be of so much importance. The true effect of a building professing to be Norman in character and feeling, is dependant mainly and essentially upon the massiveness and substantiality of its expression; thin walls, shallow recesses, and minute detail, are inconsistent in all respects with it, as has been too often proved in modern attempts at productions of the kind. We may, therefore, be excused, perhaps, if we limit observation on works of this particular style, and proceed to consideration of those less open to restriction of the sort in dealing with them, and probably at the same time more to the taste, as more refined in the treatment and execution, and, in addition, more available to what may be considered as modern necessities and requirements in the matter.

Early English and Decorated wall-arcades are more or less the common adjuncts of these periods. They occur in the smallest, and occasionally in the plainest, churches and buildings, as well as in the richest and more considerable. Some of the former are merely plain splayed arches resting on columns, which rise from the bench-table surrounding the parts of the edifice in which they appear. An arcade of this description, but trefoiled, decorates the sides of the chancel of the Church of Cowling, in Kent. It is of the first-mentioned date, and terminates on the south side against a very interesting and richly molded piscina of the same age—a view of which is given in the *Oxford Glossary, Plate* 112. At Fountains Abbey, in Yorkshire, another somewhat similar example of the plainer description of Early English arcade occurs; and the *Oxford Glossary, Plate* 6, gives another from the upper story of the Tower of Haddenham Church, Bucks. The last named has plain molded arches, rising from columns and angle responds, forming the tower piers, the impost molding of which is continued as a label over the arches. Two of the latter on each face are pierced as windows; the rest are close. The arches of the arcade at Fountains, which, differing from the above, is an interior one, are trefoiled, and, as sometimes happens in internal work, have no label, but are boldly molded. In *Plate* 25, we give an elevation and plan of a portion of this arcade, from which its appearance and nature will be readily seen.

Fig. 4, as will be perceived, is the geometrical view of one, and part of two other arches, with the plan taken through the shafts.

Fig. 5, is a vertical section of the caps of the columns to an enlarged scale.

Fig. 6, is a sectional cut through the string above the arcade.

Fig. 7, is a plan, or horizontal section, of the arch moldings, and

Fig. 8, a vertical section of the base of the columns.

Of less simply treated arcades, and of those still more highly ornate, a long list might be formed. There are good arcades of both kinds in St. Alban's. That in the presbytery and those in the clerestory of the choir are well worthy of notice. The portions of one remaining in the west porch of a richer kind are very beautiful. The Early English arcades of the nave and choir chapels at Westminster are fine examples; as are those of Lincoln and Litchfield, with an almost unlimited number of others. In particular, there is a greatly ad-

mired arcade of very ornamented character in the small Church of Stone, in Kent.* In the ruins of Croxden Abbey are also fine remains; and a highly beautiful one graces the wall of the Chapel of the Nine Altars, at Durham. The latter is deserving of the closest and most attentive examination. It is not very deeply recessed, and is formed of trefoiled arches; the moldings and other details of which are of the finest description and most effective workmanship. The character and execution of the foliaged capitals is also of a very superior and suggestive character.

Of the Decorated arcade there exist also many valuable and instructive examples. A very effective and otherwise interesting one occurs in the south aisle at Selby. Of a portion of this we give a representation in *Plate* 25, where

Fig. 1, shews the geometrical elevation of two of the arches of which it is formed, and the plan, in connexion with one of the piers of the aisle, shewing the base of the shafts and the horizontal plane of the bench table, or seat below.

Fig. 2, is a vertical section through the cornice or string above, and the arch moldings and the cuspated portions beneath them.

The letters affixed to the elevation have reference to the like ones on the corresponding parts of the section.

Fig. 3, is a section through the lower part of the shaft and base, and the projecting seat, &c.

The spandrels between the main arches are pierced through, and those of the cuspated or trefoiled portions the same. The foliage of the capitals is boldly and well carved, and the detail of all the parts very good.

This, and the similar descriptions of arcade, are the usual finish of the lower parts of the walls of chapter-houses of Early English and Decorated date, and they are applied otherwise almost universally, to a greater or less extent, to cover wall space. The number of the former cases in which they appear will at once occur to the reader; nor will it be difficult to recall to mind the prevalence of similar applications in the latter. In the richer buildings there exist some magnificent examples of both periods. The Chapter-house of Westminster has an Early English arcade, the shafts of which were originally of polished Purbeck or Bethersden marble; the spandrels being richly carved in a diaper pattern, picked out in colour and gold; as are the deeply-cut and richly-grouped moldings of the arches. At Throndheim, in Norway, the west front has a beautiful arcade, corresponding in date and character to our Early English, filled originally with statues of kings and bishops, &c. At Exeter, in like manner, a portion of, and at Wells the whole west front is a series of arcaded niches filled with statuary. At Canterbury the arcade of the Chapter-house is very fine, and the archbishop's seat, which forms part of the end range, is of still more enriched character. At Lichfield Cathedral, again, there is an arcade formed and decorated after a fashion very common in Decorated niches, both singly and collectively used. Rickman describes these—speaking in reference to Decorated niches—

* This has been engraved in the work on Stone Church, by the late Mr. Edward Cresy, and a woodcut is given in the "*Oxford Glossary*," plate vi.

as having projecting canopies "of various shapes, some conical, like a spire, some like several triangular canopies joined at the edges" (the bishop's seat, in the Chapter House, at Canterbury, just noticed, approaches this disposition), "and some with ogee heads; with, in some rich buildings, the canopy bending forwards in a slight ogee, as well as its contour being an ogee; these are generally crowned," he continues, "with very large rich finials, and very highly enriched." The canopies of the Lichfield arcade just referred to are of this latter, or curved, description, and they spring from circular shafts, having richly carved capitals, and moulded bases, resting on a broad seat or bench-table, as is commonly the case; the separations between each arch being formed by double staged buttresses, capped with gabled heads, and ornamented on the face at the upper part with crocketted pinnacles, and finials according with those which enrich the canopies themselves. Above the upper string or cornice moulding of the arcade there is a pierced parapet, crowned with a battlement, the whole forming a very rich assemblage; as the reader may observe on referring to *Plate* 6 of the "Oxford Glossary," in which a portion, consisting of eight arches of the arcade, is engraved.

As respects the constructive peculiarities of the several kinds of wall arcades, there is, as before observed, but little differing from that which was ordinarily used in the constructions of similar kind, constituting more properly arcades independent of wall attachment. The arches are formed and turned in the same manner, and have all the formative appearances of the latter, deriving only limited assistance from their connexion with the walls, or other portions of the work in which they appear; and this is likewise the case with colonnades, where they form simply wall decoration. This is proved clearly in the case of the Temple of Bacchus, at Rome, where the wall is built in between a double range of columns, the one behind the other. In the choragic monument of Lysicrates, the columnar arrangement is also perfect and distinct from the enclosing and connected walling. Under the circumstances of long lengths of architrave and superincumbent entablature in open colonnades, we have before referred to some of the contrivances made use of to obtain the requisite support. In closed colonnades, or those attached to walls, and resting, to an extent, thereon, such were less necessary, and, in these instances, the more complicated modes adopted in the other case do not, in consequence, appear.

The same independent arrangement, as regards their formation, is a feature for the most part of the mediæval arcade. In the earlier Norman examples, the arcade is simply an ornamental adjunct, rather than the constructive appendage it afterwards became. This is apparent in a large number of the erections of this age. Later, the Norman arcade is detached, the wall behind being more or less recessed. Two early instances of this occur in Christ Church, Oxford, one in the belfry arcade, noticed in *Page* 146, in which the recess is but little more than sufficient to include the back projection of the capitals; and the other, given also in *Plate* 4 of the "Glossary," as well as among the illustrations of Weale's "Rudimentary Architecture," in which the recess is much more considerable. In both these cases the arched construction is free and independent in action, and otherwise a constructive, not merely decorative, feature of the wall; connexion where it occurs, being in the shape of occasional perpend, or bonding stones, or by a continuance of the voussoirs into the wall behind.

In the Early English and Decorated periods this recession of the arcade is, in a number of examples, still more fully carried out, particularly in churches, where, in the former periods, such would seem to have been used as the seats of the clergy, or other assistants in the service, and which it is likely, from the peculiar arrangement of the arcade on each side, was the case at Cowling, before mentioned. These are generally, however, the exceptions to the commoner practice, in which the arcade acts simply as a surface decoration; the bench tables in some being projected to the required width for sitting, as above referred to. This is the case in the example given in *Plate* 25, from Selby Abbey Church, where the seat projects 1 foot 7 inches beyond the wall, the columns standing just sufficiently in advance of the same to allow of the whole of them, with their caps and bases, to be perfectly free and detached. In the example at Lichfield also, just now noticed, the bench table is projected in the same manner beyond the arcading. These are instances in which the use above suggested as probably made at Cowling has been followed. In the examples at Stone and Durham, likewise before mentioned, the treatment is more distinctly that of a wall arcade, and the construction and other practical points are arranged accordingly.

In the case of sedilia, which are to be considered as a kind of arcade, the recession is necessarily observed, and the character of the arcade of greater depth, retained. The earlier sedilias are strictly arcades of greater or less extent, and have all the constructive peculiarities and arrangements of the same. In some of the early Norman, they are a single arched recess, under which appearance they may be, perhaps, considered as partaking less of the character of the arcade than that of the niche, under which designation we shall, hereafter, briefly notice some of them. Others contain two, the generality three connected arched recesses, but there are instances of a greater number. Rothwell Church, Northamptonshire, has four, and also Furness Abbey Church: at Southwell Minster there are five. Some very good seats of three divisions, preserving more distinctly the arcaded character, occur in some of the Norman and Early English churches, and in some of the early Decorated also. A very good and characteristic Norman sedilia of this kind exists at Wellingore, in Lincolnshire. It has plain, semicircular arches, simply chamfered on the outer edge, the angles of the jambs being left square, resting on two octagon shafts, with the square abucus, the capital of one carved, the other uncarved. The arch stones are formed of three pieces, as shewn in the woodcut below, and the

shafts, with their caps and bases, stand perfectly detached; the seat or bench table graduates, or is of three degrees of height, according to the most usual practice. This is a very good plain arcade, and there are several similarly treated. In other instances, all the varied modes of ornamenting the arches exhibited in the doors and windows and continuous wall arcades of this period are introduced.

The arcaded sedilias of the Early English period are also numerous. There is a good one at Uffington, Berks, consisting of three trefoiled-headed arches, connected with a fourth similiar one, which covers the piscina.

Of a Decorated sedilia, retaining more strictly the arcaded principle, there is an example at Chesterton Church, Oxfordshire. This consists of three cuspated arches, resting on two detached shafts in the centre, and on plain chamfered jambs at the side, enclosed within a square label, the hollow of which is ornamented with the ball-flower, as are also the angles and points of junction of the cuspated spandrels between the main arches. Several others are to be met with exhibiting the same character. The later Decorated, as well as the Perpendicular, generally have more the character of niches, to which we shall next refer; they occur in both these periods in almost endless variety.

CHAPTER XIV.

ON NICHES.

Niches in architecture, both in the ancient and revived Classic periods, as well as in the mediæval age, are of very extended application, and are capable of producing the most pleasing effects. Historically, their employment is of very high antiquity. The ancients employed them largely, both in the exterior and in the interior of their edifices, using them most commonly for the reception of statues, to which their proportions were accordingly, in the first instances, subjected. There are but few existing examples of the niches of the Greeks; indeed, it has been stated that they are seldom found in buildings purely Greek, but are, where they do occur, rather the after insertions of the Romans. Among those which usually pass as Greek, however, may be mentioned the choragic monument of Thrasyllus, and that of Philopapus, the latter of which still contains statues. Of Roman examples, there are abundant remains.

"These latter," says an author from whom we have before quoted,* and whose observations on the subject we are considering, are so much to the point that we shall not hesitate to give them in extenso, were, for the most part, of "two kinds. The first serve for placing of statues;

* Billington's *Architectural Director*, 8vo. London, 1848.

the second are destined to different uses, as the *exedræ*, or hollow spaces, of greater or less dimensions, of a square or semicircular form, in walls of considerable extent. The first are situated in temples, saloons, and basilicas, between the intercolumniations of porticoes, and in plain walls; being generally about seven feet in height, so as to contain a statue the size of life, as those of the Temple of Mars the Avenger. This is the most suitable dimension, since it serves as a scale of comparison to judge of the exact dimensions of the edifice. Niches of this size were often employed in the interior of temples, when constructed of brick, as at the temple of the forum of Antoninus, and that of Venus, at Rome; together with a great number of other constructions of brick, where this description of niche has been adopted, both at Rome, in the thermæ, and at Tivoli, in the private buildings of the Villa of Adrian."

"Of this first kind of niche there were both round and square." There are some, we may add, which partake of all the segments under a semicircle. "When they were square in their plan, they were square also in their elevation; as, likewise, when they presented a semicircular plan, their elevation terminated in the same manner; variations from this rule are, however, met with. A niche, on a circular plan, with a rectangular front and circular head, is observable in the remains of the Piazza of Nerva.* Sometimes," continues our author, "they were without ornaments, at others decorated with architraves, as at the Arch of Janus: they were also employed with columns and pediments, as at the Pantheon, and in thermæ, and also at a temple at Nismes, generally named that of Diana." With respect to the niches, in this latter instance, our author says that they are among "the most beautiful models of the kind with which antiquity has furnished us." He describes the interior of the edifice as having "its two sides decorated with six Corinthian columns engaged in the walls. Each intercolumniation is occupied by a niche, placed upon a stylobate, and ornamented with an architrave, formed by two pilasters that support an entablature with a pediment." The plan of the niche is square, and, following the rule previously mentioned, its head is horizontal, or a straight one.

This employment of columns as the decoration of the niche occurs in several instances. The thermæ of Dioclesian, and the façade of the Temple of Peace, have niches with columns; the latter being supported on consoles. The ruins of Balbec and Palmyra contain also examples, many of them being also otherwise very richly ornamented.

"The second kind of niche," the authority we are quoting goes on to say, "is of large dimensions, having the pavement for its base. It is employed at the exterior of edifices, to contain groups of figures, or colossal statues, as those under the portico of the Pantheon, at Rome. Others of this description, though of still greater dimensions, were sometimes placed at the extremity, in the interior of temples, for the reception of colossal figures; as at the cella of the Temple of Venus, at Rome; and at other times in the basilicas, to contain the seats of the tribunal, as at the misnamed Temple of Peace, which Constantine employed as a basilica; and in the basilica at Pompeii."

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* Stuart's *Dictionary of Architecture.*—*voce* Niche.

The niches of this description, "presented in the saloons of the thermæ, were surrounded by seats, for ease and conversation, examples of which may be found in the different thermæ and in several saloons at the Villa of Adrian."—" Lastly, niches of greater dimensions than the preceding were constructed in walls, which served as enclosures for the thermæ, answering as abutments: some were semicircular, others square in plan, and were often employed alternately" at Rome, and also "in Greece, in the enclosures surrounding the temples, as at the temple of Jupiter Olympus, repaired by Adrian," where some of them are square and others semicircular in plan, placed alternately. " When their dimension was very considerable, they were left open at the top, and contained many rows of seats placed above each other, serving as amphitheatres for the delivery of public discourses, or the exhibition of particular games: examples of which may be seen at the thermæ Caracalla and Dioclesian." Both these latter descriptions of niche are distinguished by the term *exedræ,* before noticed: those first mentioned, as placed at the end of basilicas, were named *chalcidicum.*

It is to the first class of the niches which we have here referred to that modern attention and study may be more particularly directed: for purposes such as their original the latter are no longer required. The niche is now for the most part an ornamental figure, and unconsidered in the light of its former application. As now used, there are three classes corresponding in character with the order or composition in which they are employed. The first, agreeing with the Doric, expresses strength and simplicity, and should be without decoration; the second, following the character of the Ionic, exhibits a moderate enrichment and lighter proportion than the former, and is usually adorned with archivolt and impost; and the third, extreme delicacy and richness, according with the Corinthian, and showing usually entablature, pediment, and columns. The number of examples of the Revived and modern period, in which niches of these several characters are expressed in a way to entitle them to be referred to as models for consideration or imitation, is too numerous for more than very general and brief notice. Most of the works of the Revival school and its professors are full of elucidation and description of the best forms and treatment. Palladio shews many very beautiful niches, and almost all subsequent authors of the same class have followed his example in this respect, both in their published and material works. Later, Sir Christopher Wren, Sir William Chambers, and numerous others have left us examples of almost universal use and application.

With respect to the proportion of Classic niches, it has been before said, that, originally used for the purpose of receiving statues, they were regulated in their proportions suitably to this appropriation of them. Their height has been before given as properly not less than 7 feet, so as to be capable of receiving a statue the size of life, that, thereby, a scale might be given to judge of the dimensions of the edifice in which they appear. As connected with a more general and extended application, however, it has been fairly observed, " that it has in vain been attempted by many authors to determine the invariable proportion of niches." No fixed rule can be given here more than with the other parts of architecture. The general one for the same " is twice and a half their width in height; but the particular rule is, to divide the width of each of the three classes of niches into twelve parts, giving twenty-eight of these divisions

in height to the first, thirty to the second, and thirty-one to the third. This determination of the proportions of niches," however, it is added, "are only a species of medium terms, established to serve as approximate measures to the combinations of the artist."

Palladio, on ancient authority, as may be seen in the niches of the Pantheon, one of which we give in *Plate* 26, usually adopts the proportion of twice and a half of the width for the height; but in this he is not exclusively followed, others differing more or less. Perrault, in the niches introduced in the peristyle of the Louvre, of which we give illustration in the same *Plate*, 26, has a more extended one than even the particular proportion above given to the third class of niches, in which those here spoken of are properly to be included. He gives, in this instance, thirty-four parts or divisions of the width to the height of the niche, in accordance with the increased proportion in this respect which his doors and windows in the same front bear,—to which we have already referred when speaking of doors,—and which, in this case, has a very pleasing and relatively uniform effect. The elevation and details of these niches of Perrault are given, as just stated, in *Plate* 26, the latter being twice the scale of the former, as will be there seen.

Fig. 1, is the geometrical elevation of the niche, with its architraves, panelled frieze, and crowning pediment.

Fig. 2, is its plan, which is semicircular, showing a horizontal section of the architrave moldings, &c.

Fig. 3, is a section through the entablature and pediment, &c., enlarged; and

Fig. 4, a similarly enlarged portion of the upper part of the elevation, showing more clearly the details of the moldings and enrichments.

In this example of Perrault's, the semicircular plan will be seen to be followed by a corresponding termination of the head of the niche, according to the prevailing practice. In the other example, on the same plate, taken from the Pantheon, the same principle is observed. In this instance the plan is rectangular, and the head is, accordantly, square. This seems to have been a very generally admitted rule. In the circular Temple at Balbec the practice is exhibited in immediate and relative connexion. The lower niches, which occupy the spaces between the pilasters surrounding the interior area, are semicircular on plan, finished semicircularly and coved in the head, the crowning moldings or decorations following, also the semicircular line of the head of the niche, while the upper ones, which rise from them and form an upper range, are rectangular on plan, and have horizontal heads, capped with the usual horizontal entablature and pediment. A number of other instances might be adduced. The niches of the Pantheon, which we have above referred to and illustrated, are among the most pretentious examples of this feature—they are of very considerable size, and exhibit a treatment very elaborate, in comparison with the majority of others. There are eight of these niches—Palladio calls them tabernacles—in the circuit of the wall, each having a projected sub-basement, or stylobate, supporting a Corinthian ordonnance, as the decoration of the niche or recess formed in the main wall. The width of this recess is about 5 feet, and its depth about 2 feet, its height being, as before noticed, twice and a half of its width. The height of the entire composition is about 24 feet, and its width, taken on the face of the stylobate, about 10 feet.

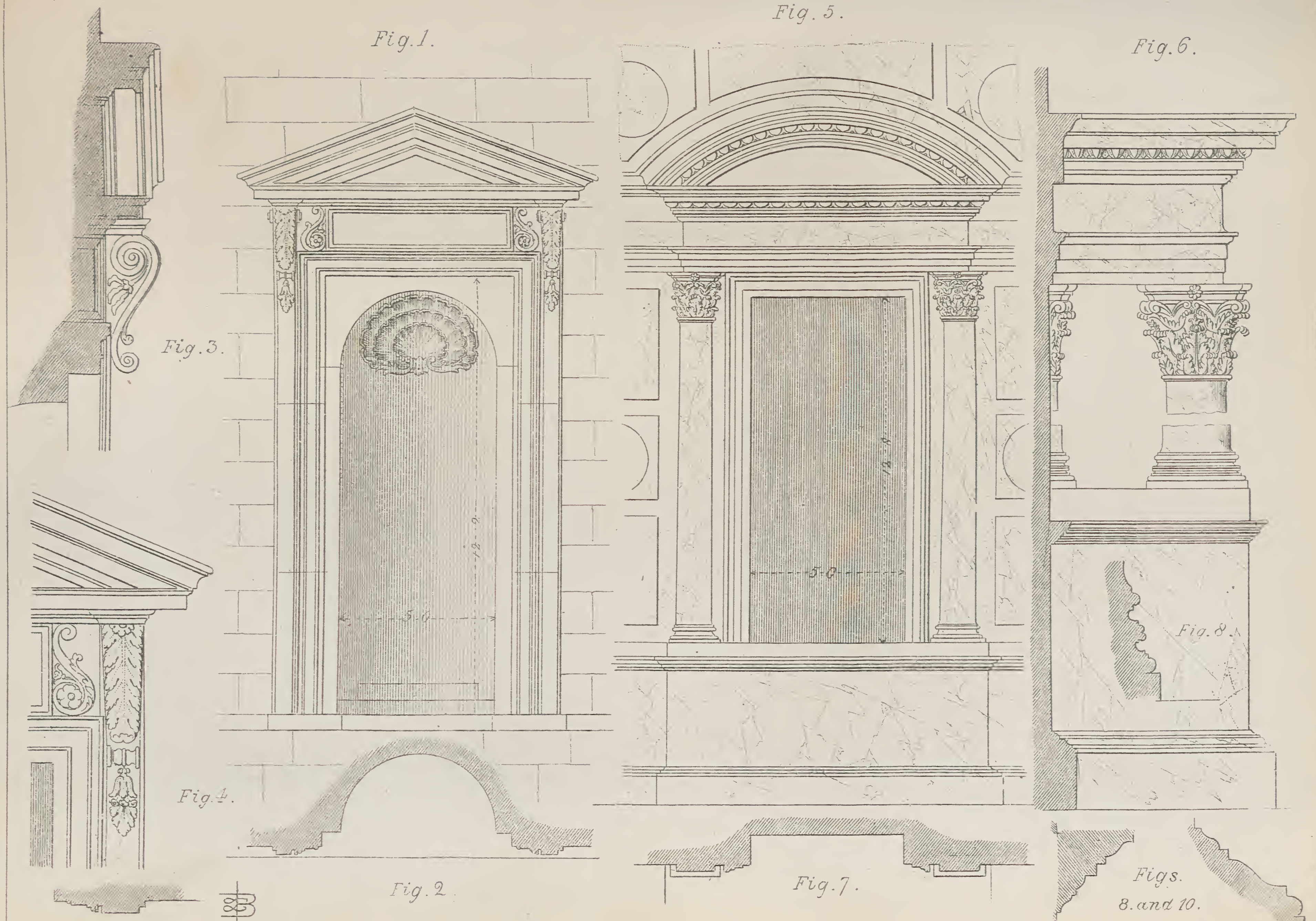
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Figs. 8. and 10.
12. 9.
5. 0.
12. 8.
5. 0.

Reference to *Plate* 26 will show in

Fig. 5, a front or geometrical elevation of the niche, with its decorations and architectural arrangements complete, excepting the statue, which was, no doubt, originally placed within it.

Fig. 6, is the side elevation or profile, showing the projection of the sub-basement, and the order it supports.

Fig. 7, is the plan of the niche taken behind the columns.

Figs. 8, 9, and 10, are details to an enlarged scale of the moldings and other parts.

The two examples of the Classic niche here given, with the general description which has preceded, will be probably sufficient to shew the nature and character of the more considered niches,—in the one case of the ancient period, and in the other of the more modern or Revived forms, copied from them, or designed in accordance therewith. Still later adaptations of those of the present day of similar kind we shall take occasion to offer a few brief observations upon, as well as to illustrate, after we have proceeded to notice the niches of the mediæval age, which, as preceding them in date, though not alone on this account, but on many others, claim previous attention.

Mediæval niches are met with in almost every possible variety. The Norman and antecedent Byzantine or Romanesque niches, frequently appear as a series of small round-headed arches, generally supported by shafts, with caps and bases more or less ornamented with carving and molding. Sometimes they are without these shafts, and finish in a similar manner in this respect to the plainer Norman windows. The arch moldings of these niches are, occasionally, very much enriched. The Norman niche is very prevalent, also, over doors of this age, and frequently retains its original decoration of statues or figures. There are several examples of this,—one, a very rich specimen, from Hadiscoe Church, Norfolk, is given in the "Oxford Glossary," *Plate* 94. Generally, the niches of this period have no great depth of recess, and the figures with which they are filled are usually cut in alto-relievo upon the stonework of the back wall, which accounts, probably, for their preservation. Perfect statues have been found less difficult to destroy, and niches in which these may have appeared are, consequently, mostly now without them. This limitation as to depth characterises also the Norman niches used as piscinæ, which are, for the most part, much less recessed than later examples. There is a very good specimen of this kind of niche at Kirkstall Abbey, in Yorkshire, which is simply a plain semicircular arch, round which the wall string is continued as a hood-mold, springing from an impost placed about nine inches above the shelf or bottom of the niche. The recess is about a foot, and the shelf is projected slightly from this to accommodate the sunk water drain. In other instances the recession is still less, the water drain being in some in part, and in others wholly, in projection of the wall line of the niche. At Towersay Church, in Buckinghamshire, the niche is a plain square-headed recess, and the water drain is projected as a cap to a semi-octagon shaft, which is continued down the face of the chancel wall. At Crowmarsh, in Oxfordshire, it is a semicircular-headed shallow recess, the water drain being wholly projected as a circular bowl, the under part of which is shelved back corbel-wise. Another example occurs at Chalk Church, Kent, where the water drain is considerably advanced, and is carried

by a carved corbel head.* At West Ham, Essex, there is another instance of this treatment. Some others might also be mentioned, and it is a mode which was continued in the next and in the succeeding or Decorated period, as well as, in some cases, into the Perpendicular. Later, the Norman niches of this kind have greater depth, and in the transitional and other styles this is, with some exceptions, still further developed. There is an interesting transitional piscina niche at Haddenham Church, in Buckinghamshire. It is a richly-molded trefoiled arch, resting on shafts, and included within a circular hood-mold or label, filled with the dogs' tooth, or four-leaved flower of this period, the spandrels between this hood-mold and the outer line of the trefoil being filled with foliage. A considerable space of wall on each side the niche is diapered also in squares, filled with four-leaved flowers, &c., and this space is enclosed, or formed into a panel, by a molding carried all round as a square frame to the ornament.

Of Early English niches, "the most important," says Rickman, "are those found in chancels, in the walls of the south side," meaning the sedilia of the clergy, to which we have before referred under the head of arcades. In his day the uses of these recesses were not ascertained, and he classes them as niches, remarking that they occur "of all stages of Early English," and "are generally straight-sided." "Statuary niches, and ornamented interior niches, of this period," he says, "mostly consist of a series of arches, some of them slope-sided, and some with a small, but not very visible, pedestal for the statue. They are often grouped under one arch, with an ornamental opening between the small arches and the large one, like the double doors." Of this kind is the piscina niche at Cowling, in Kent, of which we have given illustration in *Plate* 27†. "Except in the chancel seats, and the stoup and water drain, and in the case of buttresses, these niches," he continues, "are seldom single, but mostly in ranges." Speaking of the stoup or niche for the holy water, sometimes still seen adjacent to the entrance doors, both externally and internally, there is a very interesting Early English example at Ospringe Church, in Kent. It is a small square-sided recess, with shafts supporting a trefoiled pointed arch, beneath a semi-circular drip-stone or label. The basin occupies the whole length of the recess, which is about 1 foot 6 inches long, and is projected slightly from its depth, its interior width being 10 inches, with a depth of 3½ inches. This description of niche is not now common, most of them having been studiously destroyed. The inner trefoiled arch is in one stone, the label in four pieces, each jamb and shaft in one. See *Fig*. 8, *Plate* 27.

"Decorated niches," says Rickman, "form one of the greatest beauties of the style." He divides them into two grand divisions, which, he says, might be again subdivided, "such is their diversity." In the first he places "panelled niches, the fronts of whose canopies are even with the face of the wall or buttress they are set in. These are usually in

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* This example, a very interesting one of transitional Norman date, is singular, as being immediately connected with a sedilia or seat for one priest, also comparatively equally shallow in recess, and as having a trefoiled pointed head, while the latter is trefoiled circularly; the labels of each being carried round each head according to their respective forms. The soffits follow also the trefoil shape.

† A view of this niche is given in the *Oxford Glossary*, but by mistake is there stated to be at Cowling in *Suffolk*.

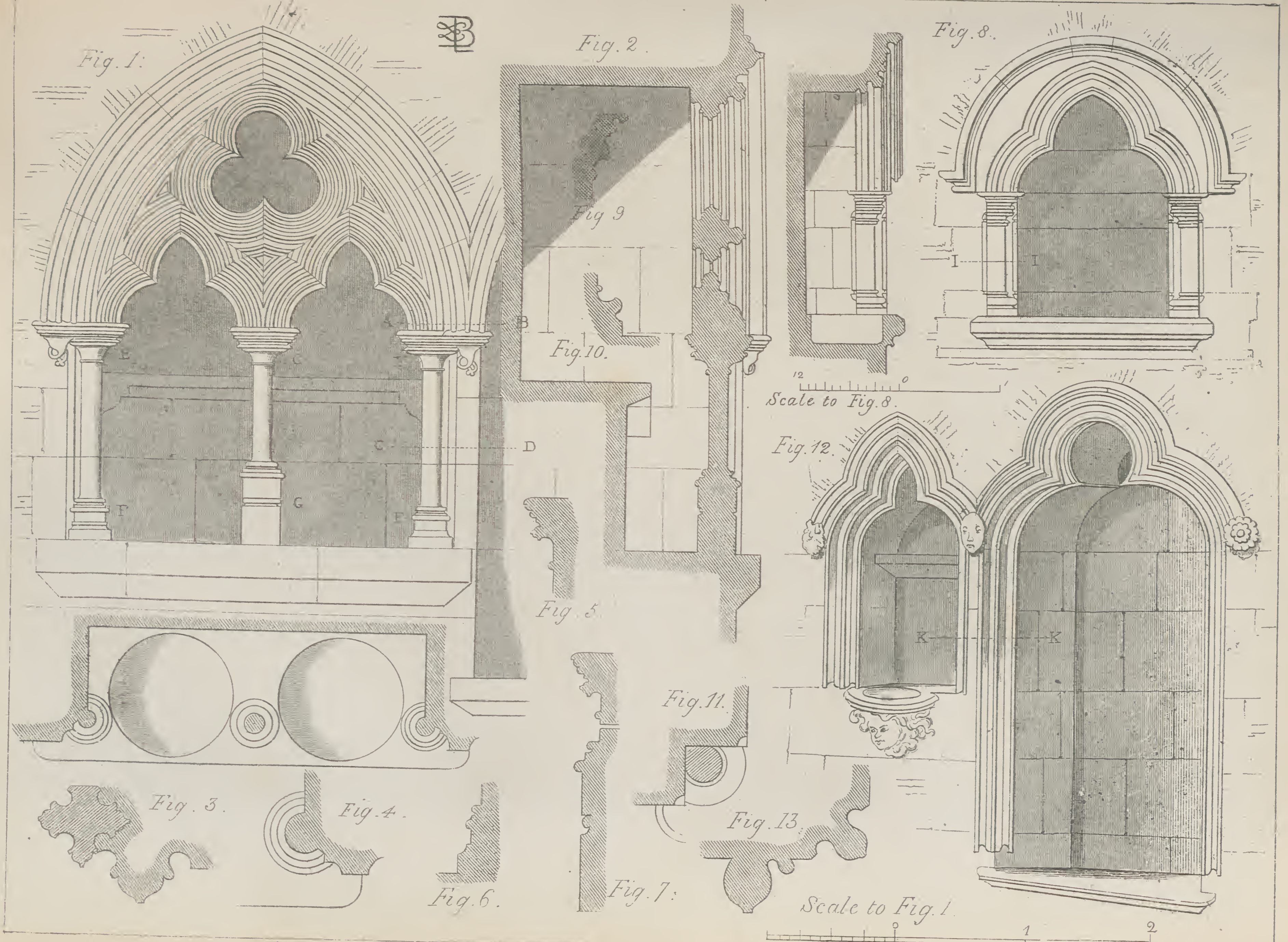
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9
Fig. 10.
Fig. 11.
Fig. 12.
Fig. 13.
Scale to Fig. 8.
Scale to Fig. 1.

plan, either square, with a sloping side, or are regular semi-hexagons," &c. In the first case, if not very deep, which is more frequently the case than previously, the roof is a plain arch; but, in the latter, " and where the depth is more considerable, as is now usually the case, the roof is often most delicately groined, and sometimes a little shaft is set in the angles, or the ribs of the roof are supported by small corbels." An exceedingly rich example of this treatment of the roof, and indeed of the whole construction, exists in the sedilia at Preston, in Kent—one of the finest examples of this age. Of the canopies attached to this division of niche, some are triangular, or straight-sided, others ogee shaped, " sometimes placed flat against the wall, and sometimes bowed out in the form of an ogee," as in the arcade at Lichfield before mentioned.

The niches of the second division of Rickman are those having projecting canopies: these are very varied, some being " conical like a spire, some like several triangular canopies joined at the edges, and some with ogee heads." All are " generally crowned with very large rich finials, and very highly enriched," and have mostly " some projecting base, either a large corbel, or a basement pedestal carried up from the next projecting face below." Sometimes, in the tops of buttresses, niches were made to occupy the whole width of the buttress, being entirely open at the sides, sometimes with small piers at the angles and sometimes with isolated slender shafts. These frequently contained statues, as do others of the closer kind. There are statues in the buttress niches of the nave of Westminster Abbey, which are of the latter description; in some at Rouen of the former.

In the Perpendicular period, " the more legitimate niches," says the " Oxford Glossary," " did not differ in general character very materially from the preceding, although there was often considerable variety in the details; they were usually recessed in the form of a semi-hexagon or semi-octagon, with a vaulted top carved with ribs and bosses; the canopies projected, and were sometimes conical like spires, and occasionally were carried up a considerable height with a variety of light open-work, with buttresses and pinnacles; in plan the canopies were usually half an octagon or hexagon, with small pendants and pinnacles at the angles; and crockets, finials, and other enrichments, were often introduced with great profusion." It would be impossible to refer to a tithe of the examples which might be adduced as showing the different, as well as varied, peculiarities observable in the niches of either period, or to select from so many those the most deserving of illustration. We have simply, therefore, endeavoured to aid the description of one or two of those we have incidentally mentioned by a graphic representation of them. With this view, *Plate* 27 gives the transitional niches before-mentioned as at Chalk and Ospringe, and the more elaborate Early English one from Cowling; and *Plate* 28, a Decorated example, of the kind included in Rickman's first division, from Eaton Church, in Nottinghamshire, with two Perpendicular ones from the buildings of the Vicar's Close at Wells.

Of the first, or that from Chalk—

Fig 12, *Plate* 27, is a perspective view; with

Fig. 13, the plan of the jamb at K K on the perspective.

Fig. 8, is the geometrical elevation of the benatura, or holy water niche, from St. Mary's Church, Ospringe.

Figs. 9 and 10, the detail of the cap and base of the same, at H H, and

Fig. 11, its plan, at I I.

Fig. 1, on the same plate, is a like geometrical elevation, with a plan beneath, of the niche at Cowling.

Fig. 2, is a section, taken vertically, through the same.

Fig. 3, is a plan (of the jamb) at A B.

Fig. 4, a similar plan at C D.

Fig. 5, the profile of the caps, E E.

Fig. 6, the same of the bases, F F ; and

Fig. 7, a vertical section through the cap and base, G G.

The above are the Transitional and Early English examples just mentioned. In *Plate* 28

Fig. 1, shews an elevation of the decorated niche at Eaton Church, with its various details, to an enlarged scale, shewing more clearly its style and construction.

A, is a section through the cornice at A on the elevation.

B, the buttress cap at B.

C, the buttress tabling at C.

D, the base molding at D; and

E, the plan of the niche.

This, as before observed, is an example of a Decorated niche of a less rich character than very frequently appears, even in churches and buildings otherwise exhibiting no great amount of enrichment, if we except their window tracery generally, and, in some, the nature of the detail in the moldings. Of the more elaborate kinds, as before mentioned, there is abundant example, as well as representation. In particular, York has a number; some of its buttress niches are very fine. Howden has also some very good and generally applicable niches. Some very effective ones are also occasionally seen in the angles formed by the connection of buttresses with the walls which they support. Of these niches there are examples deserving examination at Tiltey Abbey, Essex, and Sittingbourne Church, Kent. Of niches on the buttress faces, more or less enriched, we may refer to the churches of Donnington, Heckington, Howden, and Multon, in Lincolnshire, and, in particular, to that of St. John Leverington, in Cambridgeshire, where the buttress faces and the gable of the porch have some very good. Three niches on the west face of the tower of King's Norton, in Worcestershire, deserve mention also as very fine specimens, though these latter are properly referable to the next period as regards their date.

Of this last mentioned, or of the Perpendicular niche, we give examples, as before said, from the Vicar's Close at Wells.* (See *Plate* 28.)

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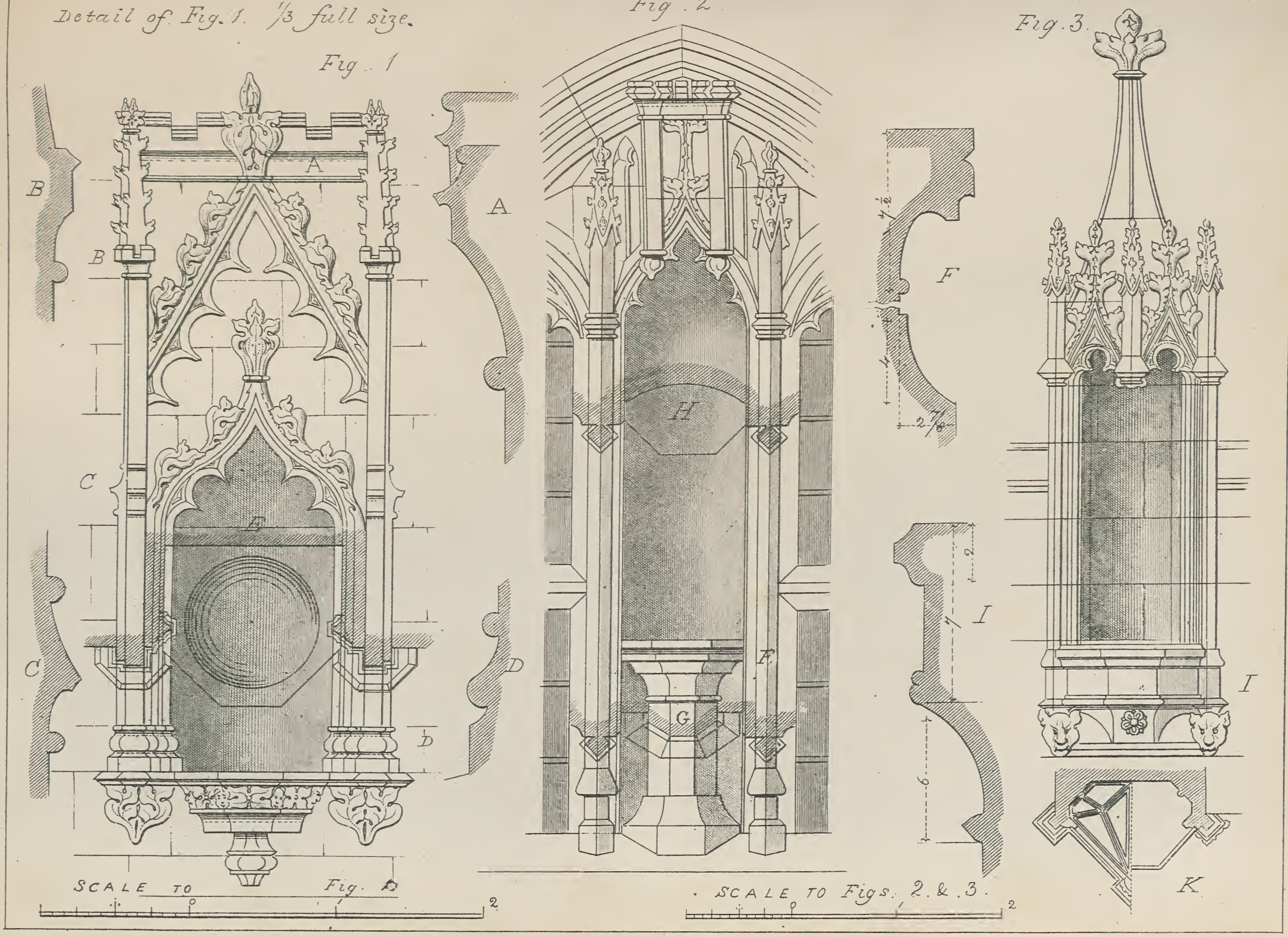
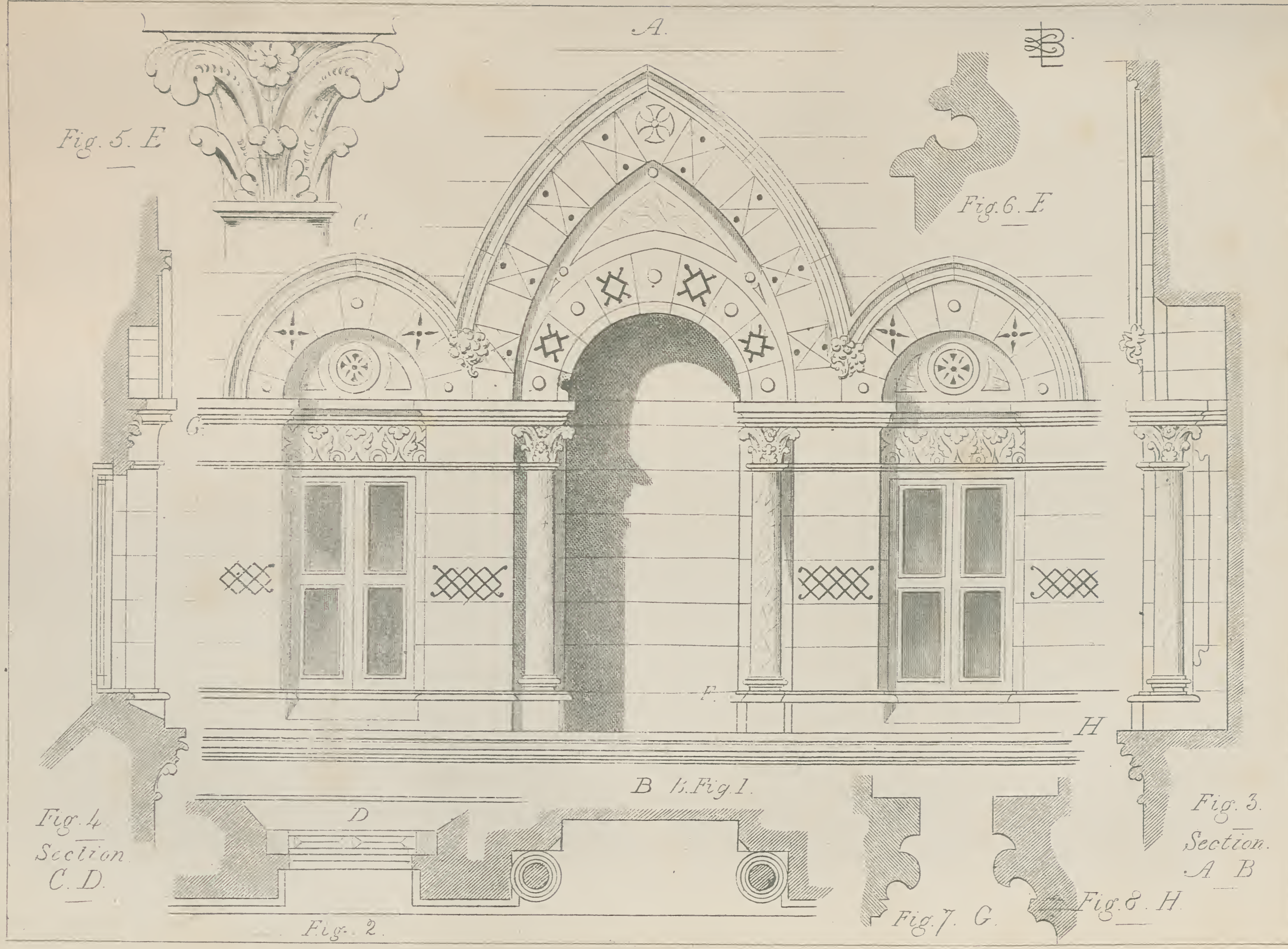
* Both these niches are represented in Walker's *Illustrations of the Vicar's Close*, but the one here figured as No. 2 is drawn to so small a scale, as to show its proportions and effect but imperfectly. It is here given to a larger one.


Detail of Fig. 1. 1/3 full size.
Fig. 1
Fig. 2
Fig. 3.
A
B
C
D
E
F
G
H
I
K
SCALE TO Fig. 1
SCALE TO Figs. 2 & 3.



London James Hagger 67 Paternoster Row.

Fig. 2 gives an elevation of the niche, formed in the centre compartments of the hall windows, and

Fig. 3, a similar elevation of the niches which enrich the angles of the parapet.

The accompanying figures shew the detail respectively of either:—

F, being the profile of the cap and base of the pedestal in *Fig.* 2.

G, the plan of the niche, taken through the die of the pedestal.

H, a plan, taken through the centre or body of the niche above the pedestal.

I, a vertical section through the lower part or base of *Fig.* 3; and

K, the plan, one-half looking upwards, and shewing the groining, and the other half looking downwards.

We now proceed to an illustration of the more modern modes of treatment in the case of the niche.

Founded upon the Classic practice, the general treatment, as regards the majority of instances, approaches more or less closely the original types, the differences being such only as are the result of a particular line of study, or created by particular taste in the embodiment of it. In many modern works, however, there is a large admission of the Italian element, as it is exhibited in the buildings of that country, which are to be classed as modified representations of the older rules and styles. Some of the niches of this kind are very beautiful, and judiciously designed and applied, with reference to the structure in which they appear, afford many opportunities for a very effective and pleasing display and variety. The modern Italianized forms of the Classic here alluded to, have been very generally considered as widely applicable to the residences of the present day, and it is from some such or other good cause possibly, that so many of our suburban and country houses are designed in this style. Be this, however, as it may, the fact of a very extended employment of it, irrespective of the beauty which, properly treated, many of its component features possess, will render any illustration which we may give the more useful, seeing it supplies more particularly an existing or immediate want. With this impression we give, in *Plate* 28*a*, a design for an Italian niche, after the fashion of the most generally approved models.

Fig. 1, as will be seen, is the geometrical elevation of the niche, with a window on each side.

Fig. 2, the plan of somewhat more than one-half.

Fig. 3, a vertical section through the centre of the niche on the line A B; and

Fig. 4, a similar section through the window at C D.

Figs. 5, 6, 7, and 8, are the various details to an enlarged scale, lettered with reference to the corresponding parts on the elevation, &c.

E, being the caps of the columns.

F, the base of the same.

G, the string or impost, at G.

H, the lower cornice.

This niche and its accompanying features might be executed, either in coloured bricks, with stone for the carved portions, or in different coloured stones, and marble or composition inlays. For the shafts of the columns in the latter case the Derbyshire and Cornish marbles

would be applicable. For interior work in rich buildings alabaster might be advantageously employed for the carved enrichments, and verde antico and giallo antico, &c., for the inlays or intagliated portions.

Many other and plainer forms of the modern Italian niche might be exemplified, more particularly as approaching nearer, perhaps, to Classic prototypes, but these have become for the most part so familiar to most interested in the subject, and have in themselves generally, as exhibited in modern practice, so little to recommend them in preference to the peculiarities of treatment observable in later introductions, that we have considered it more profitable to direct study to the principles of design and aspect of the latter, rather than to limit the mental course and progress of the masonic artist to a road already sufficiently known and traversed. There are quite enough of the modern received Italian examples,—more varied and more correct exposition is a desideratum.

CHAPTER XV.

ON PAVEMENTS.

THE pavements, stone or otherwise, anciently as well as in more modern times used in the flooring of edifices, are deserving in many instances of attentive examination and study, as models for similar applications at the present day. The earlier appear to have been very simple in their nature, as might naturally be expected, and equally so in their structure. Squared slabs of stone, of greater or less dimension, were at first commonly employed in other than the most considerable buildings, and in this shape are represented to us doubtless in the equivalent practices of modern times. In edifices of greater note, such as the temples and public structures of both Greece and Rome, richer material and more complicated as well as ornamental forms of finishing were introduced and indulged in. Floors of marble and "painted pavements" were prevalent among the Greeks. With the Romans the former, in great variety of design and colour, were constant features in both public and private erections of any note. Violet-le-duc, in his "Dictionaire Raisonnée de l'Architecture Française," says, "they often employed large slabs of marble or stone—square, oblong, polygonal, and circular, for the flooring of halls, &c., intended to receive large and frequent assemblages of people; for mosaic was not of sufficient durability under such use." This latter kind of pavement was also very generally and extensively employed by them. It is denominated the Mosaic, or Tessellated, from being formed of a number of pieces or "tesseræ." The examples which have been

discovered of this description of pavement are very numerous, and they extend to almost all those parts which were anciently subject to Roman dominion. Many very considerable remains have been brought to light at various times in England,* as well as throughout the European continent. In many instances these floors were formed of small cubes of stone and marble of different colours, arranged in geometrical and other varied forms and patterns, bedded and jointed very neatly and accurately in strong cement, and polished. In some, cubes of coloured glass were made use of, but these, open to the objection of greater liability to injury and damage from passage over, were, for the most part, limited to the mosaic decorations of walls and other parts less subjected to wear. "The tesseræ which form the majority of such pavements as have been found in Britain," says the author of Stuart's "Dictionary of Architecture"—*voce* Pavement, "are, in general, nearly cubes of about an inch square; but they are by no means invariably of that size. Some, which are of mere brick, and were used for the coarse work of ordinary apartments, were much larger; while others, which were employed in filling up the minute parts of such pavements as were worked with great labour and delicacy, are exceedingly small. They were embedded in cement, and placed on prepared strata of different kinds, as rubble stones, or blended clay, sand, and loose pieces of brick, with brick-work for the foundation of the whole. The tesseræ are of various colours, and, in many instances, appear to have been formed of stones dug from the neighbourhood of the building in which they were placed, with the addition of small dies of brick to produce a red shade, and a hard calcareous stone, of a bright white hue, resembling Palombino marble." Abroad, the discovered remains shew the same practices, as regards formation, in almost every respect.

In the middle-age pavements, the reference to the mosaic modes adopted in the Classic examples is very largely and conclusively apparent; and this is particularly the case in the earlier foreign ones. In speaking of these, Violet le Duc, before quoted, notices this, and says, "that the influence of the ancient mosaics is sensibly shewn in their combinations, each square or figure bearing a separate colour, and the total design being produced by the varied assemblage or disposition of the same," as distinguished from pattern or subject depicted on them according to the more frequent custom of latter times. Of this he gives several examples; some from the apsidal chapels in the abbey church of St. Denis, near Paris, and others from the Lady Chapel of the same edifice. He also refers to similar illustrations published in Didron's "Annales Archæologiques," and in "L'Enclycopèdie d'Architecture," of M. Bunce, &c. The pavement in the guard chamber of the palace near the Abbey aux Hommes, at Caen, is a well known example of similar construction. Ducarel† describes this as being formed in part as a "kind of tessellated pavement," the middle representing a maze, or labyrinth, about 10 feet diameter; another portion being "inlaid with small squares of different colours, placed alternately."

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* Mr. Fowler, of Winterton, published in 1801, several coloured engravings of mosaic pavements found in this country.

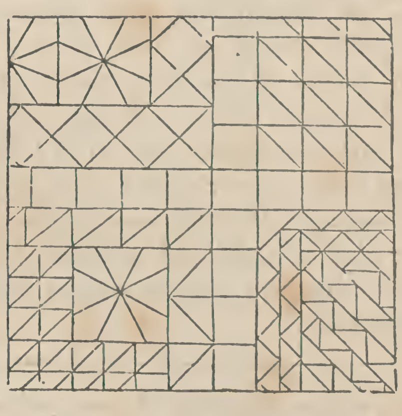
† *Anglo Norman Antiquities.*

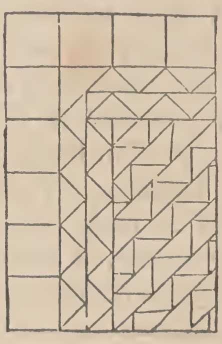
In England the same reference and mode of construction is exhibited more or less clearly in several instances, and to a later date. At Ely, the floor of Prior Crauden's Chapel (1321-1341) is strictly a pavement of this character, and that which composed originally the pavement of the approach to the Lady Chapel (1350) is similar. The construction of both these pavements are minutely described in Nichols' "Decorative Tiles." "In the former," says this author, "the tiles are of great variety of form and size, corresponding with the figures required to be represented," which is that of the fall of man, with trees, lions, &c. "The patterns are, in fact, principally made by the outlines of the tiles, though other lines, to complete the minuter parts of the picture, or add to its ornamental features, are either incised or impressed upon them."* The latter is described as "composed of tiles which fit into one another, very effectively arranged in geometrical patterns. They were originally glazed, and appear to have been of various colours, such as red, black, yellow, or green." At Rochester and at Canterbury, are also other examples of the same kind,† and one formerly existed in Louth Church.‡ A portion of the pavement of the chapel of St. Anne, at Westminster, is, in like manner, "composed of triangular and rhomboidal tessellæ."§

At Fountains Abbey was a pavement agreeing with the same principle of construction noticed by Violet le Duc as existing in the chapel of St. Cucuphas, in the church of St. Denis. In the Fountains pavement, "a cube or a quatrefoil of one colour is found inserted in a cavity fashioned to receive it in a tile of another colour, and pierced

* This pavement is engraved in the *Archæologia*, vol. xiv., plate 28.

† "In both these instances," (see note, page 63, of Blackburne's *Decorative Painting of the Middle Ages*), "the several kinds of baked clay with which the mosaic is formed have all the character of the ancient tesseræ, and are evidently imitations of the older models in a ruder and local material. At Canterbury, the varied colours in which the mosaic originally appeared are yet to be traced in many places. Green, red, and yellow are very distinct." We give the outlines of two of the patterns below.





‡ See *Gentleman's Magazine*, vol. lxxi., pages 11, 1161.

§ See Catalogue of Antiquities in the possession of the Society of Antiquaries.

through the entire thickness of the tile." In that at St. Denis, a white, or rather yellow, quatrefoil is inlaid exactly in this way in a square green tile; and, in another, a small circle of green in a yellow octagon tile.* In some, marble is imitated in the insertions by an enamel incrustation.

These arrangements and the imitations of the marbles and richer stones formerly employed, are easily understood as applied to the first pavements of the Middle Age. In the north of France marbles were not common, and their place was supplied by engraved stone filled with coloured mastics, or by enamelled brick. The first practice was long retained; and the latter became, sometimes intact, and at others under various modifications, the common form of pavement through succeeding ages. Of examples of the graven stone filled with devices in various coloured mastics, or in composition cements resembling marble, &c., there are yet some remains, both abroad and in England. The abbey church of St. Denis, before noticed, and the cathedral or church of Our Lady, at St. Omer, present them, and in Italy there are several instances.† In England specimens exist at Canterbury and Westminster;‡ at the former, in the pavement of the Trinity Chapel, and, at the latter, in that before the altar in the choir, and in St. Edward's Chapel. In describing that at St. Omer, and the subjects depicted upon the stones forming the same, Dr. Bromet, F.S.A., in a letter to John Gage Rokewood, Esq., published in "Archæologia," vol. xxx., page 537, says, "they were formed by sinking the field of a flat stone, so as to give, in the manner of certain Egyptian bas-reliefs, a cameo-like embossment to its figure. The raised portion was then sculptured and engraved with the requisite details, and the field and most deeply cut parts covered with a composition of pitch or asphaltum and coarsely powdered terra-cotta." This description would agree very well with the mode which, from the treatment of the figures, &c., would seem to have been followed at Canterbury. There is a similarity of subject also in the two cases. On the larger stones at St. Omer, some of which are nearly 5 feet square, are knightly figures on horseback; and, among the small ones, about 12 inches square, are the signs of the Zodiac. These latter are also among the subjects at Canterbury. Two of them, Libra and Cancer, with a portion of a third, containing Leo, are given to a small scale in the "Oxford Glossary," page 360. There were also here, representations of the employments of the months, and of the Virtues and Vices. Nichols, in his "Examples of Decorative Tiles," gives one of the former, a figure ploughing apparently, and one of the latter, representing Sobriety enthroned above Luxury, or Indulgence. These were all very favourite subjects with the Mediæval artists, and they occur continually in the sculptured and painted ornamentation of their architecture.§

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* The date of both these pavements is the twelfth century.

† The church of Santa Maria del Fiore, at Florence, has a monument of somewhat similar kind. The subjects represent the Zodiacal signs, with the sun in the centre, surrounded by the Scripture, "En giro torte sol ciclos et rotor igne;" which, as may be perceived, can be read either way.

‡ Of the Canterbury pavement a large plate was published by Mr. William Fowler, of Winterton, in 1807. That at Westminster is represented in Malcolm's *Londinium Redivivum*, vol. i., page 89. See Blackburne's *Decorative Painting of the Middle Ages*, note, page 63, before quoted.

§ Sagittarius is among the figures represented on the tiles from the chapel of St. Anne, at Westminster, in

Other patterns at Canterbury seem to have been similarly formed. They are, for the most part, shaped as medallions similar to the two which we have engraved below. The colours are a red-brown, with green and yellow, and they form an inlay in the plainer portions of the pavement, which, according to Gough (see "Archæologia," vol. x.) dates soon after 1174.

The pavement before the altar at Westminster is a very elaborate specimen of the same description, and it possesses the advantage of indicating very clearly what the whole design must have been in its perfect state. It was put down by Abbot Ware, A.D. 1268 (see Britton's "Edifices," vol. ii., p. 71), and is considered to be the workmanship of Pietro Cavellini. The pavement in St. Edward's Chapel has been subjected to much wear and damage, but still exhibits its original scroll pattern, formed in imitative marbles inlaid on a stone ground.

Having thus far briefly noticed, historically and descriptively, the ancient and mediæval pavements of stone formation, we will proceed to illustrate a few of the modern exhibitions of a similar practice. These, as might be supposed, are very varied in their design and compositon. Some of the older are simple alternations of black, or other colour, and white squares, either of marble or of dark slate and Portland stone. Green Anglesea marble has been employed with white stone, and, except for the monotony of the plan, with pleasing effect. Large squares of Portland stone, with a portion more or less of their angles cut off, the vacancy thus left between every four being filled with a square of another colour, usually black, is a very common kind of pavement in mansions of the last century. Sometimes a plain central portion, with a chequered border, appears in halls or apartments of a regular plan, and occasionally other variations from the more general arrangement of the black and white square.

Later examples profess to imitate more closely the ancient ones, mosaic or otherwise, and

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the possession of the Society of Antiquaries. One marked with the signs of the Zodiac has been found among the ruins of Ulverscroft Priory, Leicestershire; and the altar steps at Bredon Church, Worcestershire, have tiles of a very early date,on which the same are depicted. See Blackburne's *Decorative Painting*, quoting the *Archæological Journal* for March, 1845, and *Hierologus*, p. 304.

several very good pavements of this sort are here and there to be found. At the present time instances are increasing very largely. A very elaborate and expensive pavement, inlaid and otherwise formed of coloured stones and marbles, has been lately laid down as the floor of a portico for Lord Ward; and several specimens of a like, though, perhaps, less costly, kind have been lately introduced in other cases. The ornamental stone pavement is indeed now receiving almost, if not quite, an equal share of attention with the painted tile and terra-cotta productions of the same genus.

The great drawback, however, to the general introduction of works of this kind for this purpose is the necessarily heavy cost, and the damage under use which frequently and unavoidably at times happens. The extended use of carpeting over the floors of principal rooms in this country also acts against it. Here a marble or a stone floor, however much warmed by colour and enriched by ornamentation, would convey to many the notion of coldness, which habit and the usual sub-construction adopted have widely tended to foster. Borders of stone and marble, however, might possibly be considered less open to objection, and as more admissable in living rooms. Contact with the stone is, in this situation, only occasional, or needless, while the durability of such a material far exceeds the marqueterie in wood commonly applied to adorn this portion of the best apartments. In halls and vestibules, corridors and staircases, and such like parts of a building, there is no good reason why the old practices in this respect might not be again fully entered into. However beautiful and applicable tile and terra-cotta may be for such a purpose, it can hardly be questioned but that, with the richer stones and marbles, we have opportunities and the means of producing works, which at once, from the intrinsic value and beauty of the material, convey the idea of superior magnificence. Fond as the old Romans were ordinarily of brick and tile mosaics, their marble floors, and their wall-incrustations of porphyry and jasper, with their other applications of such materials, fully shew the view they entertained on the score of the preference to be given, when the opportunity existed, and means for indulging in it were to be obtained. Though not in possession to the same extent of the power held by ancient Rome to acquire these superior materials in all the fullness she required and made use of, we are not deficient in the means of realizing, more or less readily, much in the same way. Of Italian, French, and Belgian marbles, we have large importations, and, in many other cases, make a free use of. English, Irish, and Welsh exist at hand in large quantities. Many of each of these possess very great beauty, and some are particularly suited, as in the case of the finer-grained granites, to the purpose we are now advocating. Of the first mentioned, for superior uses, we easily obtain, as is well known, the Carrara; what is called Sicilian, or Bianca Chiaro; Bardilla; and Sienna, with the black and gold, and the green Genoa. Among the French and Belgian are Griotte, Vert Marin, Rouge Royal, and Jeanne Fleuri; and, among the native, the serpentine of Cornwall, the Devonshire and Derbyshire, the Purbeck and Bethersden, the green Anglesea, before noticed, and several fine marbles from Ireland. There are also the Scotch, Cornish, Devonshire, and Leicestershire granites, and the Guernsey; most of which latter, when polished, are useful and effective in combination. For the particular and several colours of all the above-mentioned, their specific gravities, and other particulars connected with the nature and present more general uses of

them, we refer the reader to the observations contained in our second chapter, where the kinds and qualities of building stone are fully treated of. It will be there perceived that almost any variety of distinct and interspersed colour is obtainable: the question of their introduction being simply one of patronage and sufficient willingness to incur the cost of their production. As the former is extended, facilities will arise to render the latter less considerable. It is the want of demand in this, as in many other works, that contributes to keep up, in a great measure, the cost, since the attention of the workman is not directed to the economical minutiæ of the matter, or called to ascertain practically and really the extent to which a frequent use of such materials would enable him to prepare for and to work them on this ground. It is well known that practice makes perfect, and gives ease and expedition in the handiwork portion of any art; while the advantageous disposal of material is proportionably more largely helped by the common use of a greater than a lesser quantity. Let us hope, then, that the stone pavement, in its more ornamental forms, will, ere long, have the same consideration and attention paid to it, and be as profusely used, as the enriched tile and other similar kinds which have been lately employed. There are several ways in which the employment exclusively of the richer stones might be superseded, where, on account of too great a cost, it might be desired. The old practices of composition inlays might be returned to and adopted. Much has been done in this way as applied to wall decoration on several occasions lately, and coloured cements have been very effectively introduced in a few cases in the heraldic decorations of grave stones, both in their more modern forms of upright erections, or in imitations of the old slab-stones of former days. Composition mosaics have also been, in like instances and manner, employed, and there seems no reason why the vitrified materials, seen in the modern tile mosaics and patterns, should not be applied in conjunction, as portions of pavements otherwise and principally of stone formation. Under this arrangement the ornamental portions might be so disposed as to be, to great extent, protected from heavy wear, or they might form, as before remarked, the borders to a central portion, in which introductions of a more substantial kind should be inserted, or, on the contrary, to an altogether un-ornamented stone centre. It will be unnecessary, however, to enter more than thus briefly into these suggestions, and we will therefore proceed to direct the attention of the workmen desirous of following them out to the plates given in illustration of this subject, as shewing some of the varied forms in which the ornamentation, both in the marble and composition inlays we have alluded to, may be employed with proper effect, and according to authoritative example.

The first of these, or *Plate* 29, is a representation of a pavement of Classic design, which may be formed, either of coloured stone and marble, in the solid, or of stone with marble inlay, or of a mixture of the two latter with composition insertions, in which case the latter should be limited to the smaller patterns or features of the design. As will been seen, the latter is given, the one-half as a richer, the other half as a plainer treatment of the same general forms.

Fig. 1, shews the former.

Fig. 2, the latter.

Fig. 1.

Fig. 2.

B

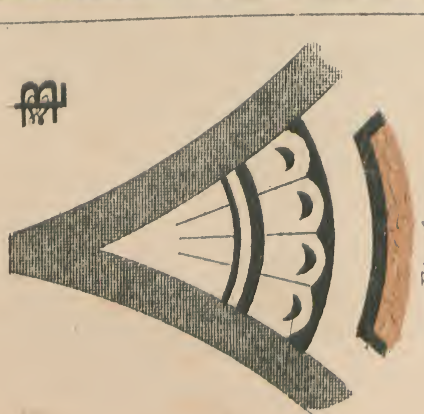


Fig. 3.

Fig. 4.

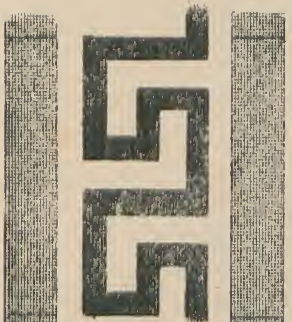
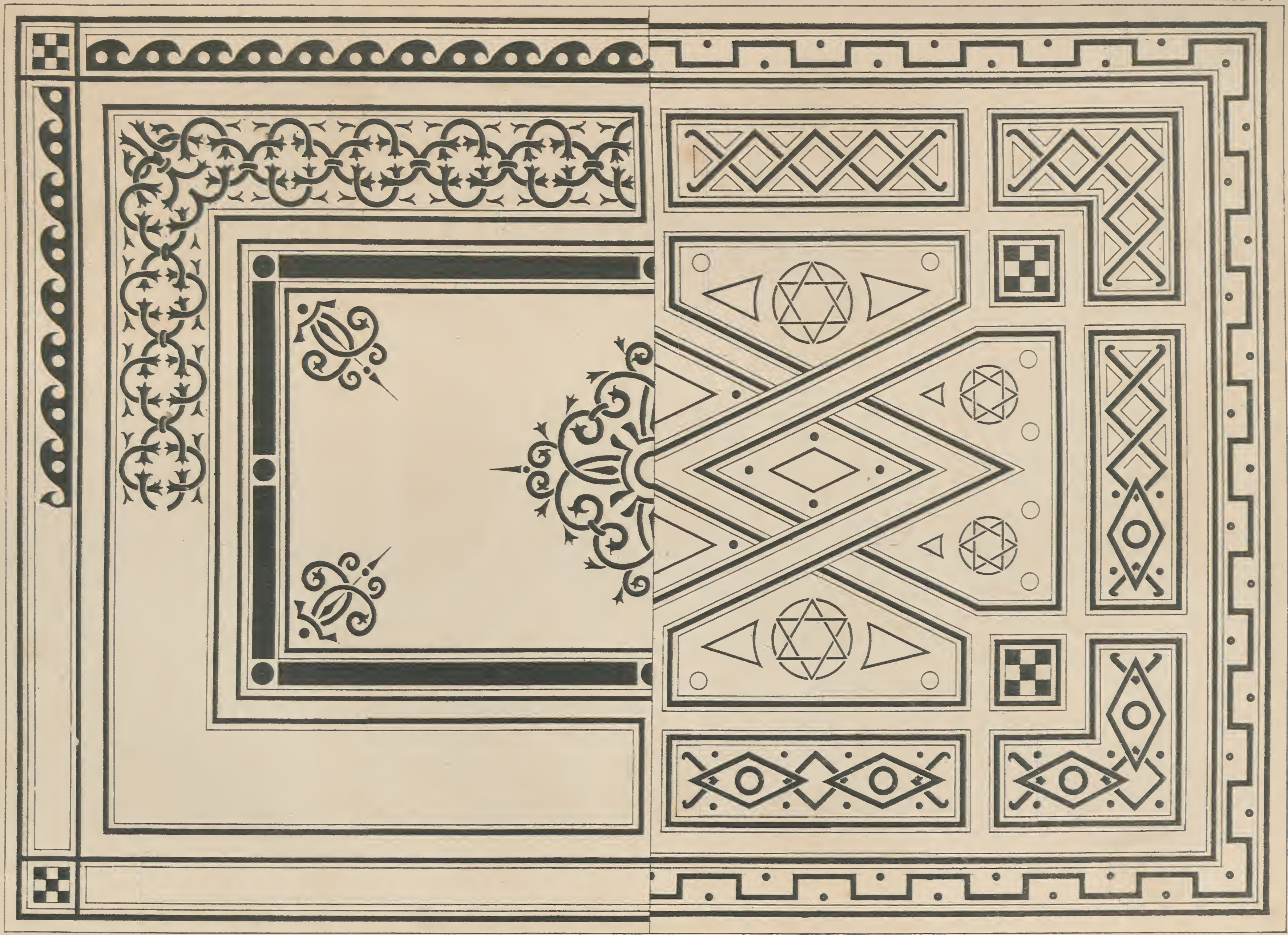


Fig. 5.



E.L.Blackburne, del. J.R.Jobbins

Fig. 1. Fig. 2.

London: James Hagger, 67 Paternoster Row.

In both the general ground is presumed to be stone or marble: the parts which form the design being either of the richer coloured marbles, in the solid, or in inlays or veneers of the same material. The dark bandings, &c., in *Fig.* 1, might be of black marble, or dark slate. The masks would have to be formed in intaglio, with strong cement, or other corresponding material, and the flower ornaments also, or by inlaid slate or marble similar to the bandings, &c.

In *Fig.* 2, the marbles might be limited to the panelled portions, all the rest being of stone, with the patterns formed by inlays and outlines of a different coloured stone, or, as in *Fig.* 1, of slate.

The three other figures on this plate shew portions of the ornament to an increased scale.

Fig. 3, being that of the spandrel portions of *Fig.* 1.

Fig. 4, a portion of the part which surrounds both designs as a border; and

Fig. 5, two of the flower patterns which occupy the space between the banding lines. Both these latter shew the manner in which the jointing may be managed.

All this decoration, as before observed, might, in rich works, be executed in the superior stones and marbles, either in the solid form, or, as respects the latter, in veneer thicknesses. Where the cost of this mode would be considered too great, imitative compositions, or coloured cements, might supersede the natural and more expensive material.

In *Plate* 30 we give two other and still more simple ideas for a Classic pavement, in which, from the rectangular character of the general arrangement in both, the cost would be, as compared with the previous designs, much lessened, not only from the less waste of material, but the greater facility in the workmanship of square forms. The only portions which involve more than ordinary labour, or entail any considerable loss on the former score, occur in these instances, in the borders and other flowing ornaments, presuming the same to be executed in real material. If incision and cement inlay be used, this objection is largely obviated.

Fig. 1, in this plate, as will be observed, shews the one-half of a pavement, of which all the main lines are wholly and strictly rectangular, the central space being simply furnished with a centre enrichment and angle ornaments to match. The exterior border is composed of the well-known Vitruvian scroll, as it is called, than which there is hardly any more effective for the purpose; the inner border, or space surrounding the centre compartment, with a scroll pattern in coloured cement, in which material it would be proposed also to execute the centre flower and angle decoration.

Fig. 2 is a similar design, varied, however, by main lines having a diagonal direction, and so forming the central portion into a lozenge. As in the first figure in this plate, the patterns are all producible by simpler means, and at less waste and labour than in the richer designs previously given; while, by a judicious choice and juxta-position of colour, they may be made equally effective.

The illustrations which we have here given, and the observations made thereon, will be sufficient to shew the character of design and the manner in which pavements of Classic profession may be, as relates to their general features and treatment, produced. Particular consideration, both of arrangement and ornamentation, is a question which involves the application of an infinite variety of forms and kinds, into even a tithe of which it would be impossible.

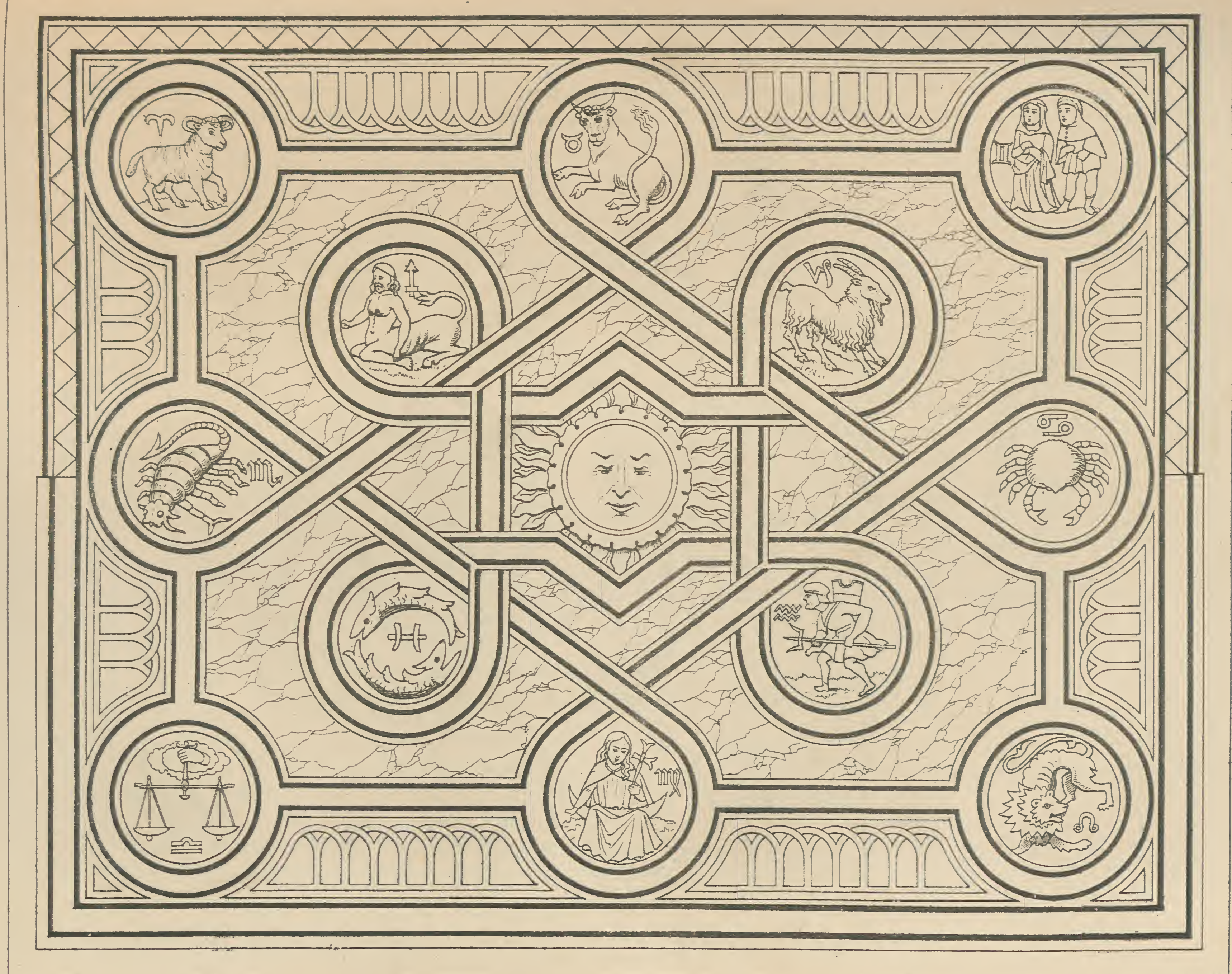
if it were not useless, here to enter. Examination, to such an extent as this, must rest with individual desire to enter more fully into the subject than can possibly be done here, and, by a lengthened reference to all the various sources from which information on the point is to be obtained, extend the knowledge which the observations we have made are intended mainly to open the road to.

From stone pavements of the Classic type we will now turn to those of Mediæval character. For these, ancient authority is not so profuse in this country as it is elsewhere As already observed, the English pavements of this age are principally of tile formation, those of stone being but few in number; the place of the richer materials employed in the more ancient examples, being, even in these, supplied with imitative compositions. From existing source of this period, therefore, irrespective of what may be gained from view of the pavements of this kind, mentioned as in part remaining at Canterbury and Westminster, we are unable to derive any extended help; so that, in designing a pavement professing to be of such character, our notion must be, in a great degree, presumptive. Our best guides exist, perhaps, and our truest ideas are, possibly, to be gathered from early stained-glass, many examples of which exhibit a treatment very apposite to, or correspondent with, some of the earlier Mediæval mosaic and other pavements of the Continent.* This resemblance would be particularly apparent in the case, probably, of the first stone specimens—it occurs plainly at Canterbury—as it undoubtedly was in those formed of tile; and however in the later ones, heraldic device, so prevalent in them, and other varieties in the patterns and ornaments employed, may have qualified and diverted the earlier appearance, there is little doubt that the original principle of composition would not be wholly lost sight of, but be more or less retained according to the period of production and the associated features of the time. This is very clearly shewn in the most perfect of the examples we have just now cited, viz , that in the Choir of Westminster. The main forms are here quite those of the pavements derived at once from Classic originals, as the same are evidenced to us abroad, and it is the more pertinent to our purpose as being a pavement of the kind we are now discussing, and as distinguished from the more common tile pavement of the time, an example on which we may correctly base our attempts at a reproduction of similar work.

In *Plate* 31 it will be seen that we have followed out this idea, uniting, in the design there given for a Mediæval stone pavement, with similar general lines to those of the Westminster example, ornamentation of a kind for which we have equal and direct resembling authority in that of Canterbury.

It will be unnecessary, in explanation of this plate, to do more than refer the reader to the observations we have already made as to the prevalence of the particular ornaments here chosen, in early Mediæval decoration generally, as well as particularly in the way we have applied them. The signs of the Zodiac were always favourite representations, while the reference to the solar system was perfected usually by the introduction of the sun as a centre, as here given, or in other similarly connected position.

* By an inverse procedure, the elder Mr. Cottingham, in his restorations at Rochester Cathedral, introduced, for the glazing of the windows, patterns taken from the pavements.



E.L. Blackburne, del. J.R. Jobbins.

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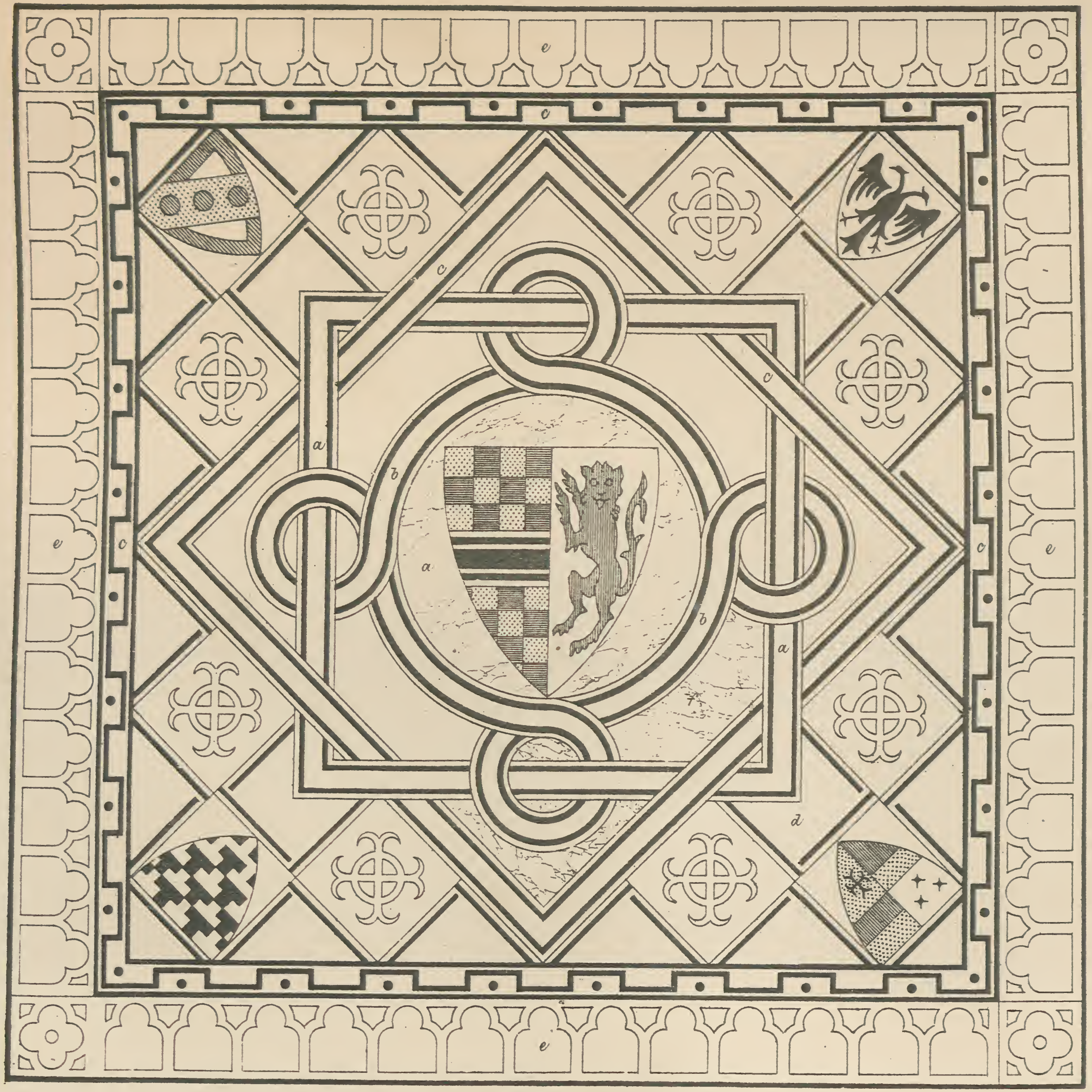

Fig. 1.

Fig. 2.

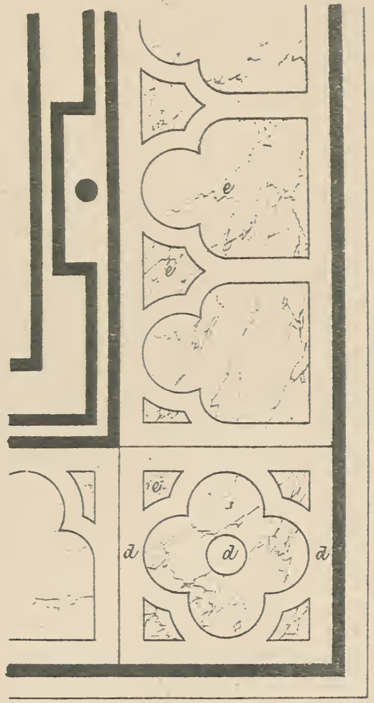

Fig. 3.

Reference to Color in the Inlay.
a. a. Red Serpentine Marble
b. Green Do: Do:
c. Milos Do:
d. Portland Stone
e Blue Anglesey Marble
f Jaune Antiqua Do:

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The mode in which this pavement might be most readily produced would probably, as respects the pictured subjects, be little different from that followed, apparently, in the Canterbury example. The stones containing the latter are incised, the figures being left in low-relief, and the inclosed surfaces and outlines afterwards filled in with a dark composition, "seemingly," says Nichols, "a mixture of pitch and pounded brick." These might be similarly treated now, and the cavities filled with the harder cements, coloured. The main lines of the pattern, enclosing the subjects, might be formed in coloured marble or slate, and the general ground in stone, enriched with inlays either of marble or vitrified material in imitation. This would make an effective pavement, and at a comparatively reasonable cost.

Plate 31*a* is a design for a similar pavement of a later character in treatment to the preceding. Heraldry was always a prevailing decoration in mediæval works of this kind, and its introduction is capable at the present day of being equally satisfactory and pleasing. In the adoptions of this species of ornament, the use of incision and coloured cements has an advantage over the introduction of similar ornament in tile, to the extent that, in the latter case, expense is much increased where a number of different bearings are required to be inserted, seeing that a separate mold has to be made for each differing tile; while it would be incorrect to consider that an heraldic device, suitable and referential in a particular case, could be indifferently and generally applied. Under the use of stone, the different coats have of course still to be cut, but the work is not lost, or attended with the waste of the mold or pattern, which occurs under the other process. This would be of some consequence in large works, such as a church or other pavement, in which the arms of a number of benefactors were to be given, and it would apply also to one in which it might be desired to introduce family genealogy and alliance. On the score of wear, the incised stone thus filled is probably hardly to be considered quite so durable as the tile, but it has been proved capable, and to some extent too, of withstanding a considerable amount—and there are certain situations in which pavements thus executed could readily be admitted as clearly not likely to be subjected to more than this.

It will be seen in this plate that the quarry principle is that of the main arrangement, and that the general ground is formed of alternate squares of dark and light-coloured stone. The former might be Purbeck, or stone of similar description—and the latter light-coloured stone having incised or inlaid ornament—or these might be composed of white ornamental tile, as in the case of tile pavements. Similar arrangements of Purbeck stone are observable in some instances in churches of the middle age, both alone and combined with inferior and plainer kinds. In such combination as here suggested, they would have a very good appearance. The Welsh green, and some of the darker-coloured Derbyshire and other native marbles, would also be applicable. For the heraldic introductions, coloured cements would be the prevailing material, and particularly with regard to the charges. For the fields of the shield, or for the simpler ordinaries, where it might be considered desirable to give richness, marble of suitable colour might be introduced, and would have the advantage of giving something like the appearance of the diapered grounds often seen in mediæval heraldry. In the case of a chequered bearing, such as that exhibited in the ancient coat of the Warrens, which, in ordinary language, may be described as composed of alternate yellow and blue squares, or in similar arrangements to that

shewn in two of the shields given in the plate, this would be in almost every respect easy and applicable. For natural and other objects represented in their proper form and colour, the incision of the lines and the insertion of cement must, of necessity—unless large expense is indulged in—be had recourse to, and this would be the case also with flowing patterns, such as foliage, scrollwork, tracery and arabesques introduced as borders or otherwise. In the border shown on the plate, as the least expensive plan, the same might be composed of lengths of white tile of the same description as those proposed for the centre, or they might be of stone, the tracery worked in a slight square relief, in the same way as the stone is prepared to receive the inlaid flint-work of Norfolk and Suffolk, and the ground filled with the coloured cement, or, in richer works, a real inlay might supply the place of the latter.

CHAPTER XVI.

TOMBS AND SEPULCHRAL MONUMENTS.

Confining our observations to modern times, and excepting, to an extent, the studies and productions of a few of our more eminent sculptors, among whom may be included Bacon, Banks, and Flaxman, the subject of the proper treatment of tombs and sepulchral monuments has been, for many years, comparatively neglected in this country. The remarkable works of the Elizabethan, and immediately succeeding period, with their elaborate introductions of alabaster and different coloured marbles, &c., of which so many examples yet remain in our old parish churches, are almost the last in which original thought and artistic execution are at all combined. However faulty in comparison with the unrivalled productions of this kind which were exhibited throughout the middle age, there is in these much that it is in vain to look for in the works which have been since patronised and considered to possess all the requirements of a good and appropriate memorial. Slabs almost destitute of any, and certainly wholly so of sculptured, decoration, and in no wise conveying, generally, more than a lettered record of the worldly position of the deceased, placed against the walls of the churches, with plain head and foot-stones, sometimes connected by a coffin-shaped stone, which might be less objected to did it really contain, as it presumptively indicates, the body, seem for long to have afforded entire satisfaction. With the late advance in architectural knowledge, and consequent better appreciation of the beautiful and fitting in these cases, the dawn of a better state of things, and a return to the sources from which our forefathers drew their inspiration, is fast approaching. This, it is possible, the establishment of cemeteries, lying without the boundaries of towns, may, in some measure, also, have aided. These, laid out with a view to picturesque effect, have created the feeling that the hitherto favoured designs are not the

objects generally to accord with the natural beauties which are usually prominent here. Some considerable advance and improvement, as the result of this impression, has, in consequence, already taken place, though all that might be desired has not yet been arrived at. Many are still unfortunately far from what correct taste and feeling would select, and offend largely against the rules which should regulate, and the appropriate expression which should characterize, the memorials of the Christian dead.

The designs with which we shall presently illustrate this subject will, it is hoped, at least offer suggestions for a less objectionable treatment than the majority of those here alluded to exhibit. Previously to referring to these, however, it may be necessary to say a few words on the history of tombs and sepulchral monuments, in so far as regulates their different forms and appearances at different times. This will be of some assistance in directing to the proper features and expression of them, according as they profess to follow the character of the ancient authorities we possess, or are founded upon the principles they establish. The most ancient form of sepulchre, it is considered, was the tumulus. "The sepulchre of King Dercennus," Mr. Dodwell* observes, "was, according to Virgil, a tumulus;" the second form was the pyramid, and the *spelaion* was the third. The first generally contained sarcophagi, and were sometimes ornamented with an inscribed slab or column, noticed by Homer in his "Iliad," and which Mr. Walpole describes as being a feature of the most ancient form of tumulus, viz., the heap of earth. In some were contained galleries and chambers; such was the case with one opened between Smyrna and Pergamos; another, "in the plain of Athens, was found to contain a chamber, finely constructed, of large blocks of stone, in which was a vase of terra-cotta, with figures and inscriptions." One of the most considerable among the remains of this kind is that at Panticopœum, now called Kertch, in the Crimea, and which has been called by some the tomb of Mithridates. "It still exists almost entire, having a fosse in front.† Its sides exhibit that stupendous masonry seen in the walls of Tiryns, where immense misshapen masses of stone are placed together without cement, according to their accidental forms. Dr. Clarke compares it to the cairns of Scotland, but its exterior betrays a more artificial construction." Its interior is described as a vault "formed of enormous slabs;" thus agreeing with the practice followed in many other ancient tumuli.

Other forms than the tumulus also occur very early, but to these, or to the second and third forms before mentioned, it is unnecessary, perhaps, to refer more than very generally, since modern wants and practices have but faint relation to their peculiarities. Some of the tombs of the ancient inhabitants of Campania "were formed by an enclosure of cut stones, and covered with a sort of roof, or flag-stone, shelving on both sides. Among the sepulchres at Agrigentum were troughs, one over the other, sometimes arched, or chambers with vent-holes

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* Tour in Greece.—See Stuart's *Dictionary of Architecture.*

† This protection takes, in other cases, the form of a wall. "In parts of western Scythia tombs are found encompassed with a square wall formed of large square stones;" and in early tombs of this class in Greece and Asia this is also the case. That near Pergamos, noticed in the text, was surrounded by a circular wall.

in the root, only two inches apart from each other." In some parts of Greece and Italy are excavated bell-shaped sepulchres, as at Amphissa.* "Another form observable is a square basement, supporting five round pyramids, as that on the Appian way, erroneously termed the tomb of the Curatii, and one among the remains of ancient Alba."

With all these various forms and differences, together with those suggested by the pyramid, or embodied in the last of the three earlier forms before mentioned, the present time is in chief only historically interested. Practically, we can now make but little, if any, desirable use of them. The practices of the later periods of Classic antiquity are, perhaps, the most ancient that we can now usefully refer to, and of these probably the Roman, rather than the preceding Greek. The latter do not appear to have largely differed from the former in the main, the character of the details, and the nature of the ornament constituting the chief variation. Both nations appear to have followed nearly the same customs as respects the disposal of their dead, and in the case of inhumation, the general structure, together with the use and internal arrangement of the tomb, is, if not quite so, very nearly identical, and the internal arrangements for the reception of the body nearly the same. In the earlier cases, as formerly noticed, the Greek tomb appears in many cases as a sepulchral chamber of greater or less size, sometimes excavated from the rock, and sometimes more strictly a construction. Some of the Campanian tombs have been before noticed as of this latter kind—being enclosed with worked stone and having a shelving roof. Many of the earlier Roman tombs were also constructed in a similar manner. A Roman sepulchre discovered near the walls of the city of York "was an oblong room, with a ridged roof, covered with hollow Roman tiles,"—"it contained several urns, all standing on a tile pavement." This tomb was but of small size, being about three feet and a half long within; but sometimes the Roman tomb, or rather sepulchre, was, as occasionally with the Greeks, of very extended size. One discovered in Oxfordshire was, in the part explored, twenty feet long by eighteen wide, and eight feet high. Another, discovered on Chartham Hill, in Kent, contained three apartments. "One apartment, which was complete, was nine feet three inches by seven feet three inches, with the inside of the walls covered with fine white plaster, on which were painted stripes of black and red; the urn containing the ashes of the deceased, was deposited on a pavement within." The walls of the three apartments extended thirty feet, and were formed of rubble stone and hard mortar. These instances, however, are not so much tombs as sepulchral chambers, and have reference to a period antecedent to the general practice of an inhumation. "When, after the introduction of Christianity, that of cremation ceased, however," says an authority formerly quoted, † "the converted Romans and Britons betook themselves to the use of sarcophagi, or stone coffins;" and such have been found in this country in several instances: "Roman coffins of brick and burnt stone also occur." In a Roman sepulchre, discovered in 1794 at Ashby Puerorum, in Lincolnshire, the sepulchred urn was enclosed in a stone chest, or coffin, with a lid which fitted the sides neatly and rather hung over the edges. The chest was of free stone, such as is

* See Stuart's *Dictionary of Architecture*, quoting Dodwell, as before.

† Stuart's, *Dictionary*, quoting Gough's *Sepulchral Monuments*.

found in abundance on Lincoln Heath. At Lincoln, also, was found "a coffin or chest, similar to the *cist-vaen* of the Britons, formed of four stones, with a cover of the same, in which was likewise enclosed an urn." In a Roman vault, discovered in the suburbs of York, in 1807, was found "a sarcophagus cut out of a single grit stone, and covered with a blue flag stone." "The length of the sarcophagus was seven feet, breadth three feet two inches, depth one foot six inches, thickness four inches." Several other instances of this kind might be mentioned, shewing the frequent use of the stone coffin and the sarcophagus tomb during the later Roman period in England.

With the Saxons, though it is believed they had previously the same practice of burning their dead as the Romanized Britons, "the custom of interring the body," says Turner, in his "History of the Anglo-Saxons," "had become established at the era when their history began to be recorded by their Christian clergy, and was never discontinued. Their common coffins were of wood; the more costly were stone. Thus a man who had been buried in a wooden coffin was afterwards placed in one of stone."—(Bede, lib. iv., c. 19.) One of the earliest notices of the Saxon stone coffin occurs in the case of the removal of the body of St. Etheldreda into the new church of Ely by the Abbess Sexburg, and from this time their use is often referred to.

The stone coffin in the Saxon period, however, would appear to have been, equally with the more ordinary wooden ones, placed beneath the surface; nor does it appear that such were upraised upon the floor, or constructed in the form more strictly of a tomb, as was the case at a subsequent period. Even when the custom of burying persons noted for their piety, or their dignity, or from their being benefactors, within the Church itself, had fully attained with them, this would appear to have been still the case, it being reserved for an after period to exhibit the tomb in a more or less distinctive and elevated shape, though it is observable that the old practices were long retained, and are still shewn, in the incised slabs of Yorkshire and other stone counties.

Gough, after observing upon the scarcity of the earlier examples of tombs in this country, divides the existing specimens into eight different forms, embracing in such those which date from the twelfth century, that is to say A.D. 1100, to modern times.

The first form he gives is the "coffin-shaped stone, prismatic and plain at the top;" the

Second form: "Prismatic and carved at the top, with crosses plain and fleury."

Third form: "Tables or altar-tombs, with effigies or sculpture."

Fourth form: "Tombs with festoons or arches," that is to say, testeres or canopies "over them."

Fifth form: "Tombs in chapel burial-places," that is to say, chantry chapels, "consisting chiefly of open screens with doors," enclosing a table or other tomb.

Sixth form: "Inlaid with brass, representing figures of the deceased, and inscriptions in cameo or intaglio."

Seventh form: "Against walls, which chiefly occur since the Reformation."

Eighth form: "Detached buildings, as domes, obelisks, columns, and equestrian statues."

Of the first form here mentioned there are several specimens,* some of them very beautiful, and applicable to modern uses; indeed something of the kind has been long retained, though mostly in a shape which has but little of the old propriety of expression or feeling. It is one, however, quite capable of being treated so as to exhibit a due retention of both, and it has the farther advantage that we have no lack of authority for the application of similar forms to Classic design, when it may be desired that this latter style should be adopted.

In *Plate* 31*b*, we give four designs for coffin-shaped tombs, of the kind we are now discussing.

Figs. 1 and 2, are of Gothic design, of the description of those included in Gough's first and second forms, just noticed.

Fig. 3, is another variety of the Gothic, which may be perhaps more properly called the gravestone shape, of which a very beautiful and rich example formerly covered the remains of Gundreda, the sister of the Conqueror, in Lewes Abbey Church, and is now restored and preserved in that of Southover, in Sussex. Of this latter kind of gravestone there are several other instances, some adorned to the same extent with sculpture of a similar kind, and others less rich, and very frequently shewing various forms of the cross, both plain and enriched. Such occurs in cases too numerous to be mentioned, raised in slight relief from the ground of the slab, sometimes with and sometimes without a surrounding inscription. It is also a prevalent feature in the incised gravestones before mentioned, as common to Yorkshire and the other stone counties.

Fig. 4, is an idea for a Classic tomb of the same type, the originals of which may be considered as shewn in the early Greek and Roman sepulchres, referred to at page 171. In this design it is of very simple character, being merely a shelving tomb, approaching somewhat to the sarcophagus shape. In *Plate* 32, however, we give, in *Fig.* 2, another example of a rather richer kind, and further ornamented with a pedimented headstone, having supporting consoles at the sides, and a sunk panel for the inscription in the face of the upright stone.

Fig. 1, in the same plate, shews a Gothic version of the general idea represented in *Fig.* 2, and in Plate 36, which we now refer to because it exhibits this class of tomb, the Gothic element is still further carried out.

In this latter plate, as will be seen, the coffin-shaped plan and contour is retained, with the addition, as in the two last-noticed examples, of the ornamental headstone, decorated, in this instance, with heraldic insignia, a crocketted and pinnacled gable, or head, and supporting shafts; the upper surface or flat of the tomb being correspondingly enriched with a floriated cross.

Referring to the plate—

Fig. 1, gives the plan of the tomb, taken at A A on the elevation, to half the scale of the latter, shewing the cross, and also a section through the headstone and its attached shafts, or columns.

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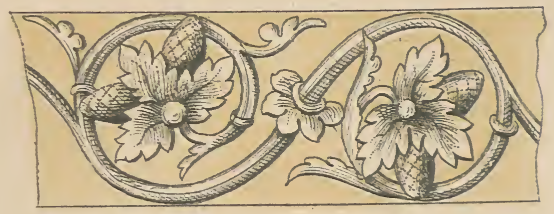
* Those of Theobald, Archbishop of Canterbury (1160), and of Bishop Granville (1185), near the altar in Rochester Cathedral, may be mentioned among others.

Ridge Fig 1. enlarged.

Ornament on the Flat of Fig 3. enlarged



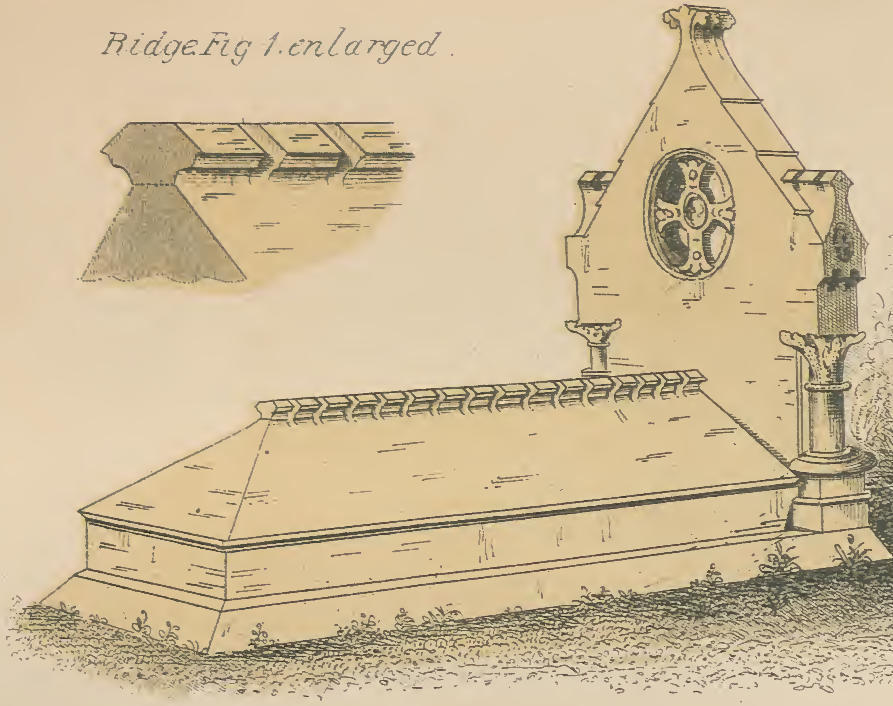


Fig. 1.

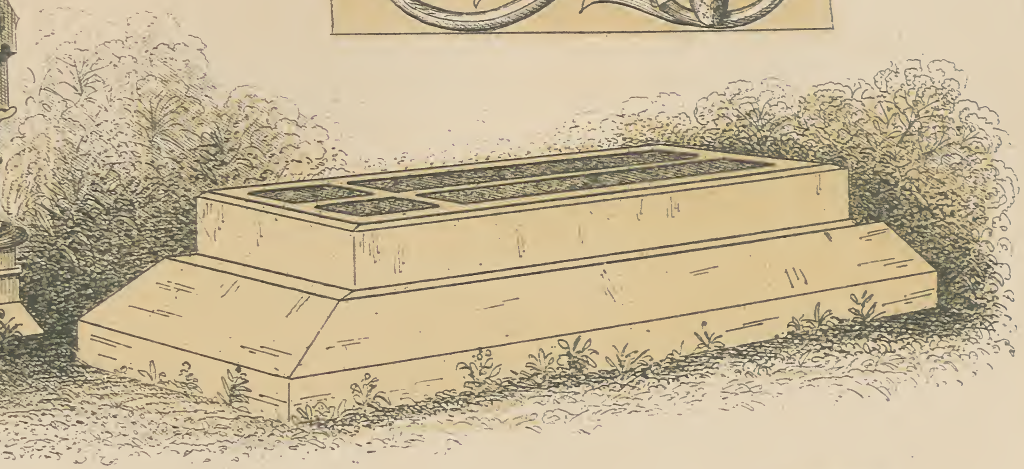


Fig. 3.

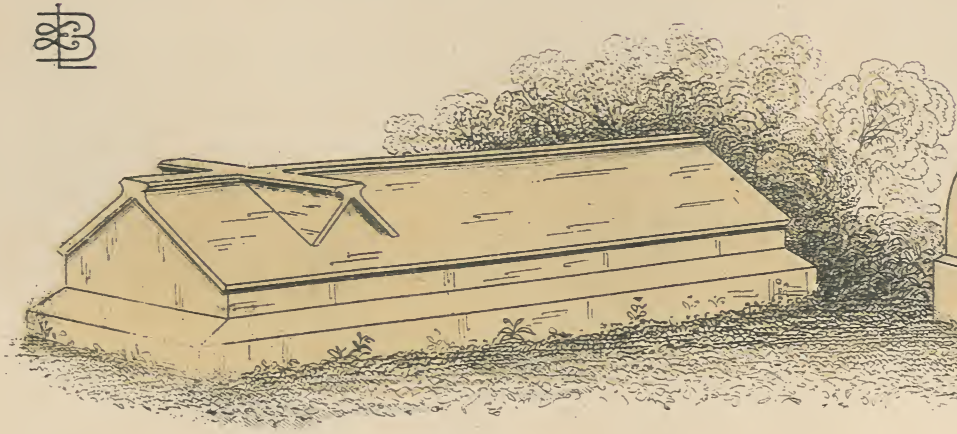


Fig. 2.

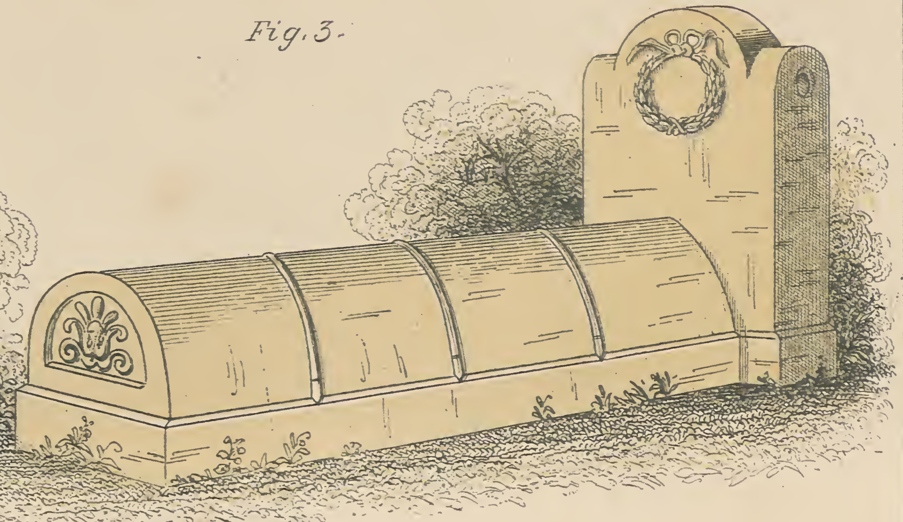
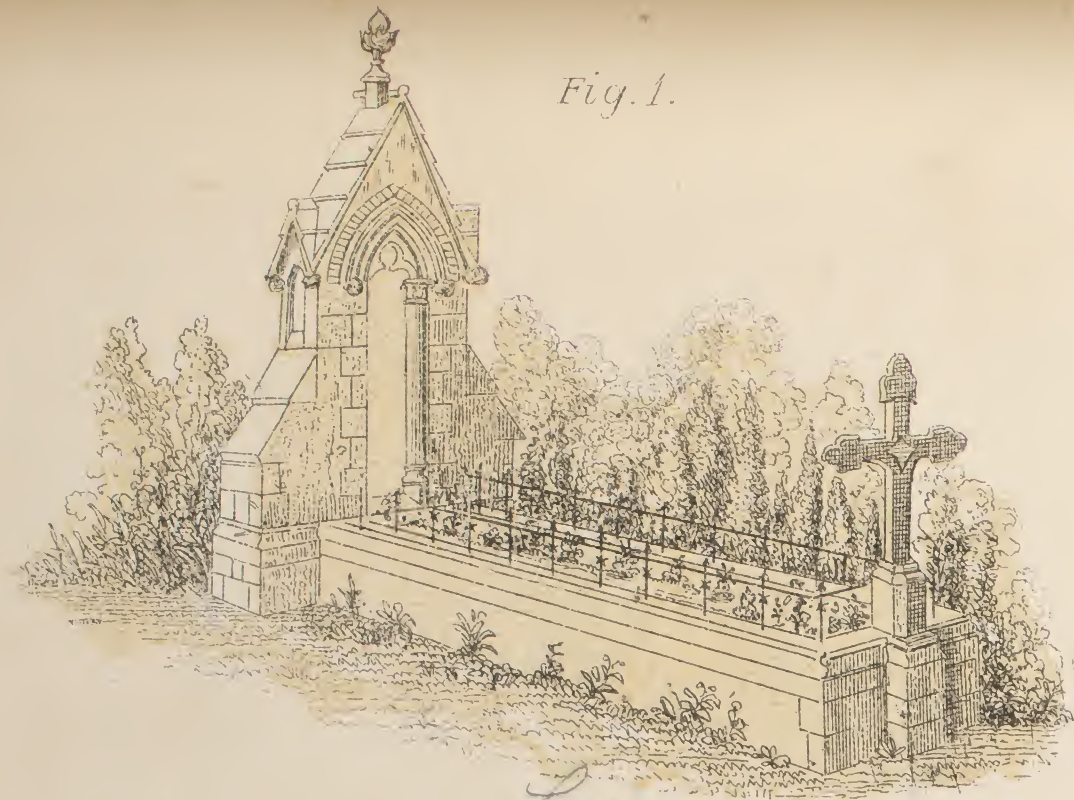


Fig. 4.

London. James Hagger. 67. Paternoster Row.

DESIGNS FOR TOMBS.

Fig. 1.



£ 20

Fig. 2.

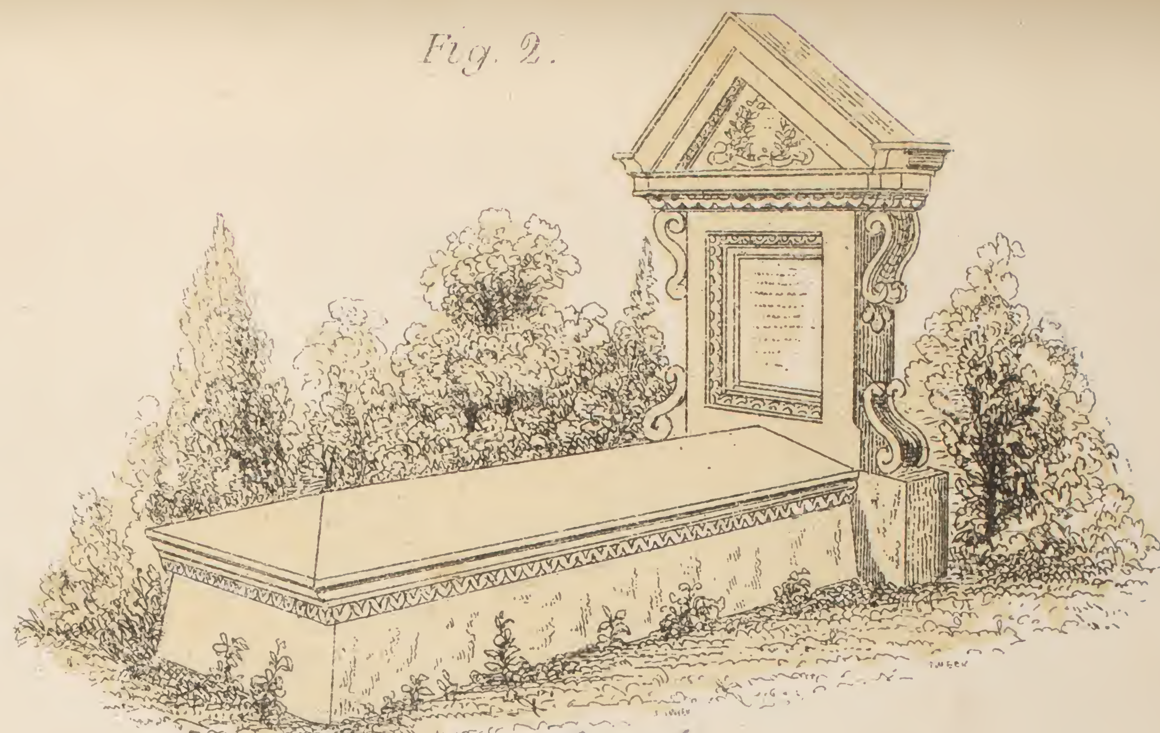


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Fig. 3.

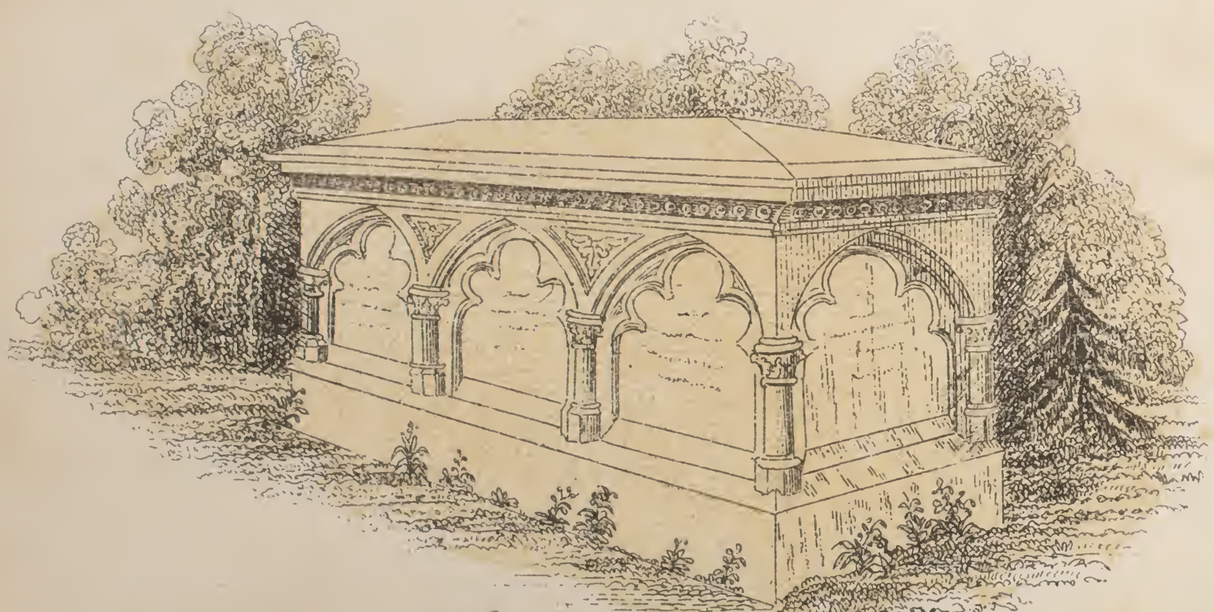

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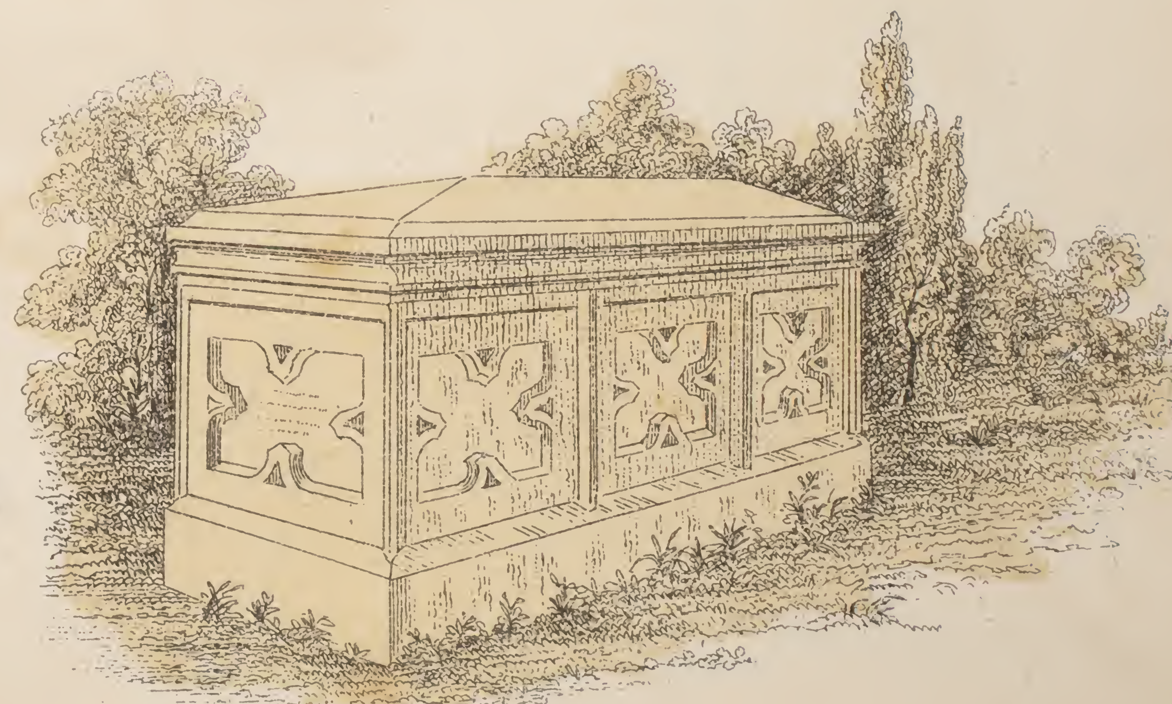
Fig. 4.



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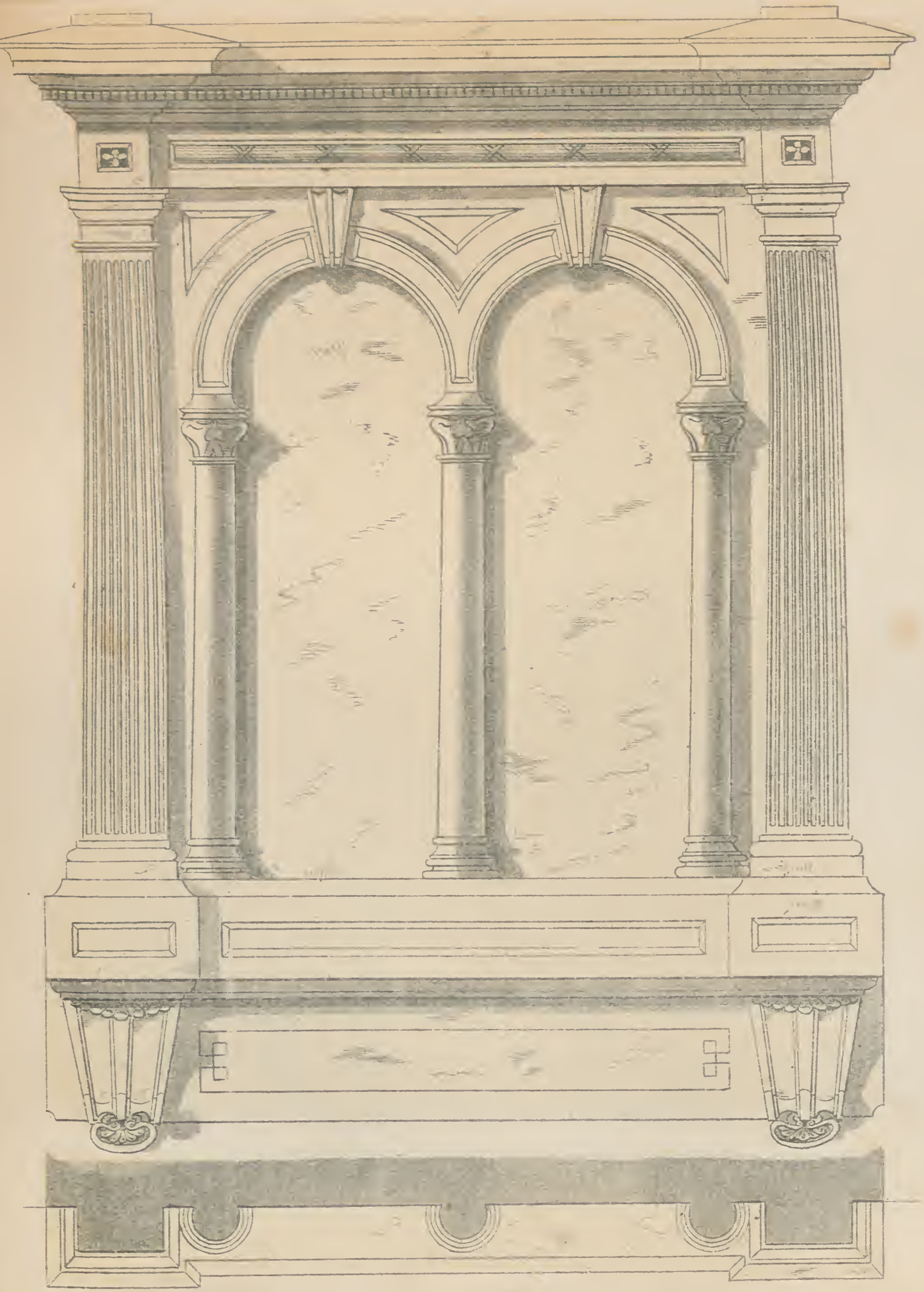

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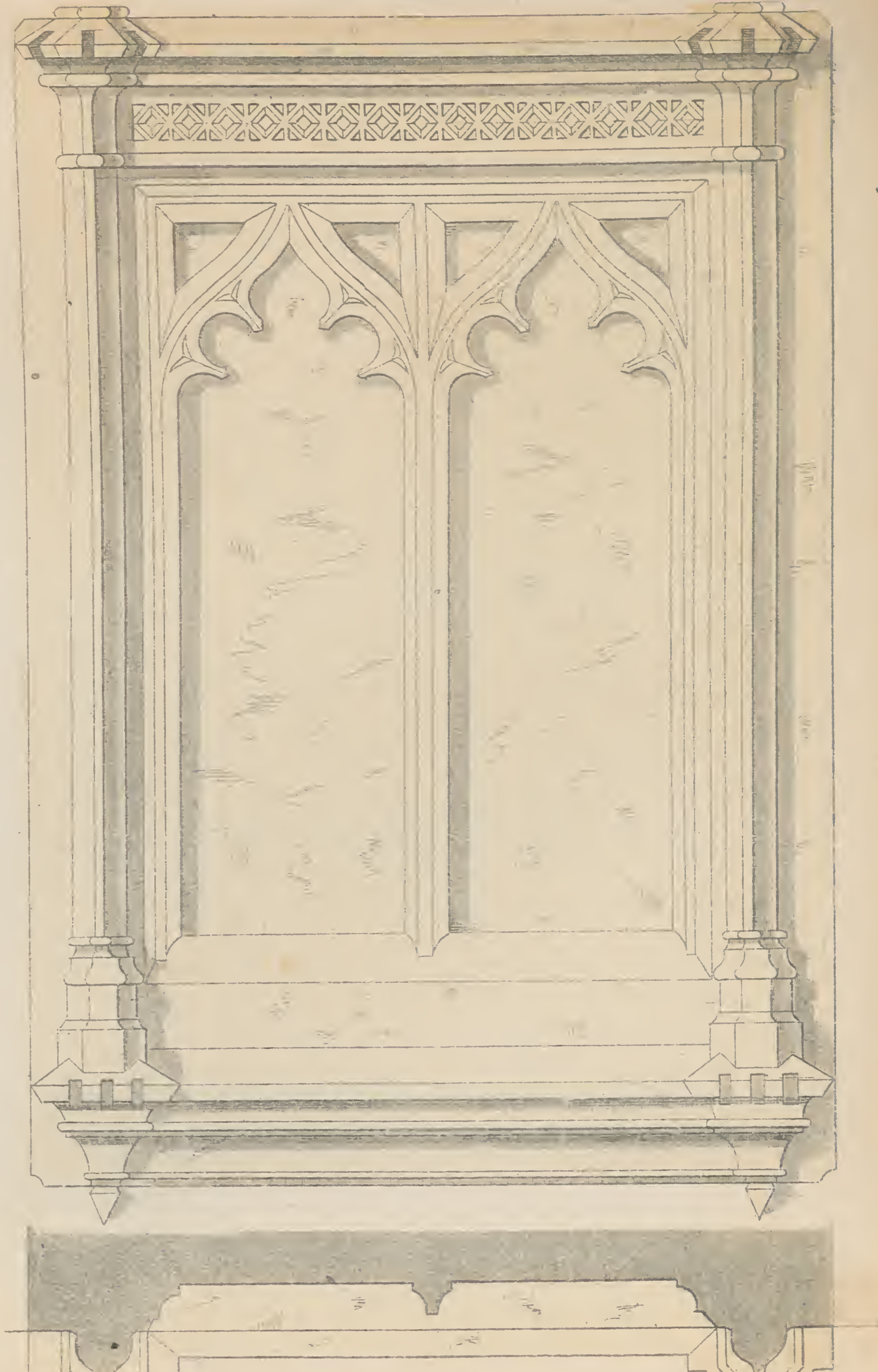

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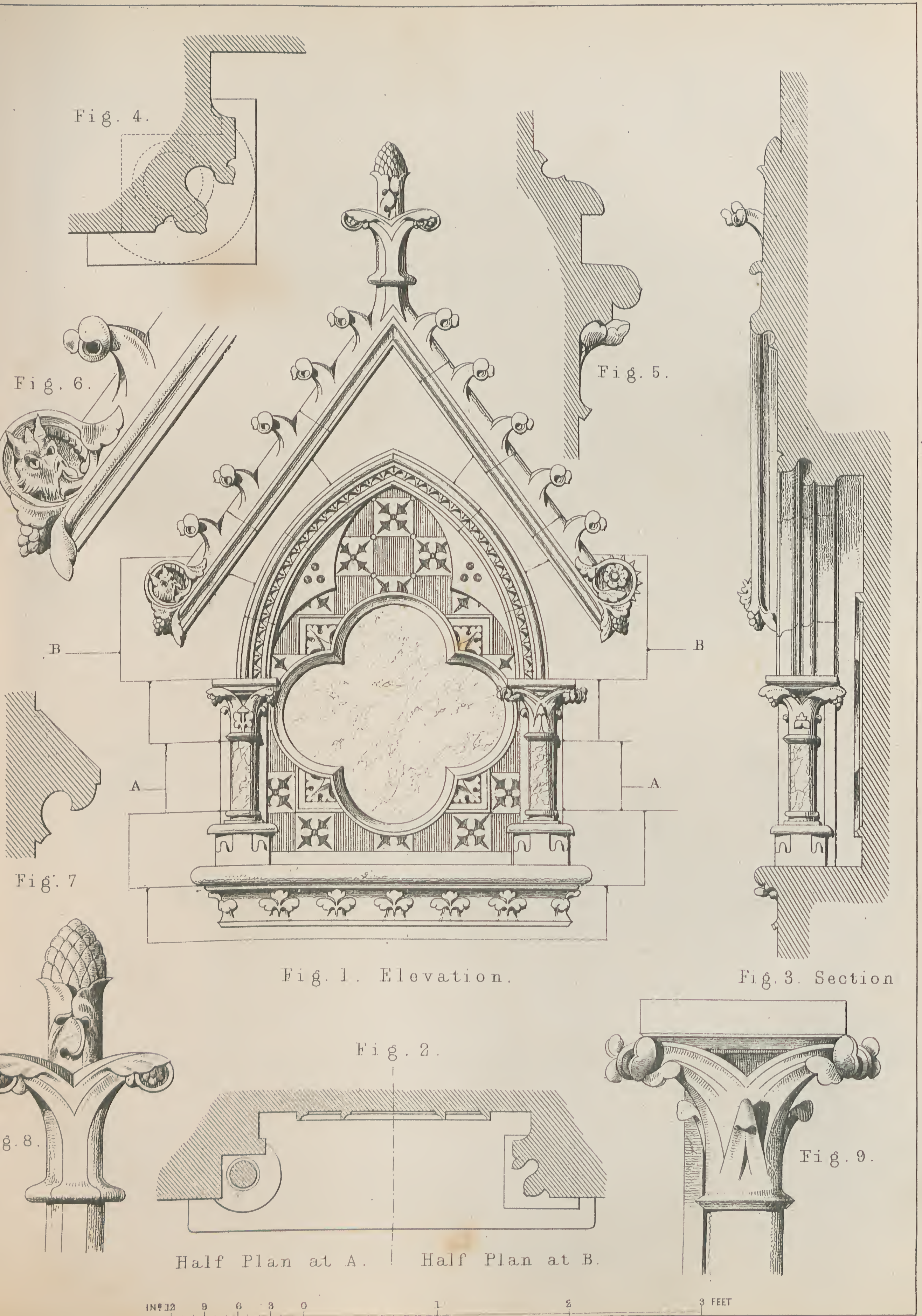

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Fig. 2.

Fig. 1.

Fig. 3.

Fig. 4.

£ 30

Fig. 5.

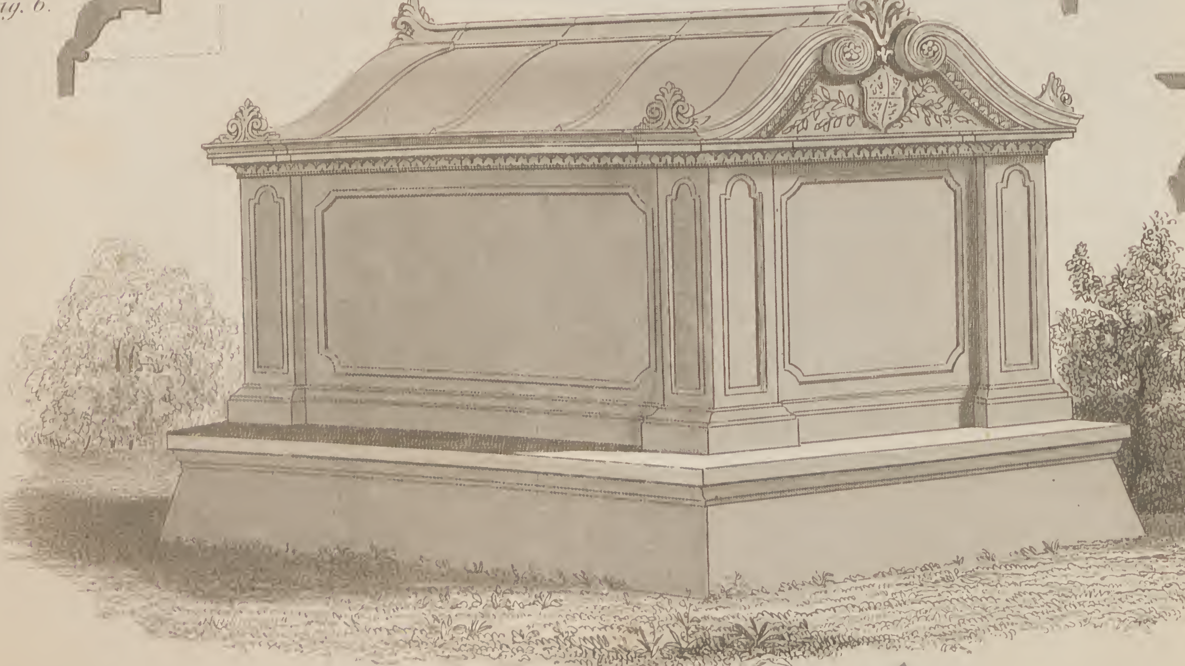

Fig. 6.

Fig. 7.

Fig. 8.

W. H.

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Fig. 2, is the front elevation, as viewed from the foot of the tomb, and shews the marble tablet beneath, and the enriched face of the gable or pediment.

Fig. 3, is the side elevation of the head-stone, shewing the return, or end finish, of the hood-mold of the pediment, and the mode in which the coffin-shaped tomb itself is connected with the headstone and its base.

Fig. 4, is a section taken vertically through the headstone, shewing also, like *Fig.* 3, the connexion of the latter with the tomb proper.

Fig. 5, gives a section through the base of the side columns, to an enlarged scale:

Fig. 6, is an enlarged representation of one of the crockets, with a portion of the hoodmold or cornice, and one of the flowers which enrich the hollow of the same.

Fig. 7, is a sectional cut through the enriched molding, which finishes the lower part of the pediment above the caps of the columns; and

Fig. 8, is a like section through the hoodmold, given at large in *Fig.* 6.

The next or third form of tomb, viz., that of the table or altar-shaped, there are innumerable varieties of, originating in the custom of burying the remains of saints and other holy men beneath the altars of the early Christian Church. In the middle and later periods of the middle age, some of these were very beautiful, and a number of them yet remaining will at once recur to the memory of those who may have felt interested in the matter. The tomb of Robert, Duke of Normandy, surnamed Curt-hose, in Gloucester Cathedral, is one of this description, with the effigy in full relief, and those of Hubert Walter, Archbishop of Canterbury (1163 to 1205), and William Longespée, Earl of Salisbury, (1225), and John of Eltham, at Westminster, are others. Those here mentioned are, however, among the richer examples. Many of a somewhat plainer, though of the same general character as respects the table form of the tomb, were long and universally employed, and have indeed remained, in many cases, to the present time. The main idea of this latter kind is shewn in the two designs given in *Plate* 32, *Figs.* 3 and 4; the former having arcaded sides, the latter panelled.

Partaking in some degree of the character of tombs of this class, though associating therewith some of the features of the Classic sarcophagus, are two designs for sepulchral monuments in the latter style, which we give in *Plate* 34. Of these—

Fig. 1, shews the elevation of an altar-shaped tomb, crowned with a sculptured frieze and cornice, and covered with a receding sarcophagus roof; the whole standing on a plain stone slab as sub-base. As will be seen, festoons of flowers and angle cartouches, the former on the authority of the custom observed by the ancients of hanging flowers on the tombs of departed relations and friends, as memorials of affectionate regard—a practice still extensively followed by some of the continental nations—decorate the frieze, heraldic shields enclosed within wreaths filling the end panels, while those of the central or longitudinal compartments are left plain for the reception of the inscriptions. The bedmold of the cornice is also enriched with carving, and there are angle acroteria, or ornaments, at the four corners of the latter.

Fig. 2, is a section through the cornice moldings.

Fig. 3, a similar section through the molding which encircles the side and end panels; and

Fig. 4, a like section through the basemold of the tomb.

The second example on the same plate, shewn as *Fig.* 5, is a further one of the same kind, having, however, probably somewhat more of the Greek character than the preceding. In this the tomb is elevated on a sloping basement, crowned by a projecting molding of Greek contour. The body of the tomb has angle antæ, or pilasters, the face of each being panelled, and is capped by a roof of ogee form, the gabled ends or returns of which are formed into curved pediments ornamented with sculpture, and finished by a centre stele, or ornament, which acts as a stop to a raised ridge. Angle ornaments, as in the last case, are placed at the foot of the pediments, and the lateral and end faces of the tomb are panelled for the inscriptions in like manner. The details, to an enlarged scale, are given in *Figs.* 6, 7, and 8; the first, or *Fig.* 6, being a section through the cornice; *Fig.* 7 a similar section through the base molding of the tomb; and *Fig.* 8 the section of the crowning molding of the basement.

With respect to the materials to be employed, stone is presumed. Portland or the *best* Bath would be applicable. Marble might be introduced in the panelled portions and in the frieze of *Fig.* 1, if it were desired to increase the richness of effect, and the basements might be granite. On the other hand, where economy is an object, the carving might be omitted and the roofs formed by a simple slope, hipped all round as in *Fig.* 1, or stopped by a corresponding shaped gable, of which *Fig.* 2 shews the enriched idea.

For illustration of the testered or canopied tomb, Gough's fourth form, it is only necessary, perhaps, to direct attention to the numerous examples which yet remain in our cathedral and other churches, &c., all of which more or less vividly exhibit the distinguishing peculiarities of this class, which has been but very sparingly referred to of late years. As the precursor of the next succeeding form, and from the more general appearance of them in the interior of buildings, they have been possibly considered as less fitting for exterior adoption. A very good and generally known example of their application, in this latter way, occurs in the case of the monument of Abelard and Eloise, in the cemetery of Père la Chaise. This is strictly a canopied tomb, and is a good authority from whence to derive ideas for similar introductions. Several of the other examples which we have mentioned as existing in the interior of our churches, may also be consulted with advantage towards the same end; and this particularly applies to specimens such as the tombs of Edward II. at Gloucester, Guy de Bryan at Tewkesbury, and a number of other similar instances, as it does also to many of a less elaborate character.

To particularise further in respect to these would extend observation beyond the limit here necessary to be observed. For this class of tomb we must therefore be content to refer the reader to the specimens themselves, and to already published illustrations of them. almost equally numerous.

The next class, or that of the chapel tomb, may be disposed of in few words. It may be questioned how far this can be now generally admissable in its more correct form, which presumes and accords with the existence of a different state of religious idea and feeling. Viewed simply as an enlarged representation of the canopied tomb, or as a minor mortuary edifice or enclosure round the sepulchre of the dead, there is little reason against its adoption; and in the case of the admission of this, it will be only necessary to follow the course already pointed out

with respect to the former. There is abundant example of this description of memorial, as with the kind previously mentioned, and it may be considered a matter of great regret that the masonic artist is only so little likely to be called upon to exercise his skill thereon.

The sixth form—that of the gravestone or tabled slab, inlaid with the effigies, &c., in brass—has been in several instances applied of late years. This kind of memorial is, however, less dependant upon the mason than the worker in metal. In a similar manner, and by way of incision nevertheless, it may be brought more directly and absolutely within his province. It has been before observed, that in Yorkshire and other counties where stone is abundant, many gravestones are found bearing figures and other ornaments so depicted in the stone. Among the ruins of Jervaulx Abbey are some very fine ones, and at Braithwell Church is another. In this latter instance the lines of the floriated cross, with an inscribed scroll surrounding its head, which it bears, is incised in precisely the same way as the old brasses, and they would appear to have been afterwards filled in and perfected by a black composition. A very effective memorial might at the present day be made by adopting the same method, both in the simpler form of darkened outline only, or in the richer ones of coloured representation and heraldry. In the case of memorials by way of wall tablets or mural decoration, this would be particularly available, and effect considerable reduction in cost, as compared with the modern ordinary introduction of marble and carved work in this shape, and which in their earlier and later kinds constitute the seventh form, which Gough dates us subsequent to the Reformation.

The most considerable and the richest specimens of this class of monument are of the age, generally, of Elizabeth and James, when the Italian element had superseded the earlier and purer Gothic, and in plainer and less extensive form they were for some time retained. Most of them are, however, in either case, as a whole, unsuited to present requirements, and at variance with received notions of good taste. There are many, however, from which a correct judgment might select parts and combinations which could be rendered well subservient, and of very good effect, in modern compositions of the type. This would be especially the case where the introduction of marble, and other coloured material, was designed to be a feature, as it was in the majority of the examples of the periods just alluded to. Some very beautiful results might be attained by a proper and judicious application of these earlier adoptions of the wall tablet of this class. The same may also, under like circumstances and restrictions, be said, doubtless, with respect to wall tablets and mural monuments designed in the still earlier, or Gothic styles, although we have not the authority of real example to guide or sanction such work. This form does not occur in a direct shape in the more strictly Mediæval periods. The nearest approaches are the inscribed sentences, and other marks, which distinguished the spot where the heart, or other separated portion of the dead, was deposited; or the "Orate" which was inscribed upon the wall, or screen, or other feature of the structure, in commemoration of the donor thereof or contributor thereto. It is capable, however, equally with memorial windows in stained glass, which have lately been largely introduced, of adding much and appropriately to the interior adornment. A mural tablet, properly and accordantly designed with reference to the construction of the building in which it was placed, would beequally suitable, or indeed,

might be conjoined or identified with spandrell ornaments and sculpture between the arches, and in many other parts of a church.

In *Plate* 33, impressed with this view, we give a design for an early Gothic mural monument of the kind we have been referring to, and which might be placed, as just suggested, between the nave arches, or against any other unoccupied space of wall. The style partakes of the early French, and, as will be seen,—

Fig. 1, represents the front elevation, shewing the quatrefoil-shaped tablet for the inscription, laid on a diapered ground, the outer arch resting on detached shafts, and crowned with a pedimented or gabled hoodmold, enriched with crocketting and finial. The general material might be Caen, or any of the finer freestones. The diaper should be alternate squares of dark stone or coloured marble, and white stone inlaid. The shafts might be serpentine, or any of the richer marbles, or polished Purbeck; or the richness might be made still greater by the employment of alabaster.

Fig. 2, shews one-half of the plan taken through the jamb at A A, and the other half through the arch-molding at B B.

Fig. 3, is a vertical section through the monument, shewing the depth or extent of its recess, &c.

Fig. 4, is a plan or horizontal section through the arch-mold, just above the abacus of the cap, to an increased scale.

Fig. 5, is a vertical section through the base of the columns and the string from which they rise, also to an increased scale.

Fig. 6, is an enlarged view of one of the end terminations of the hoodmold or label.

Fig. 7, is a sectional cut through this label; and

Figs. 8 and 9, are enlarged elevations respectively of the finial and the capitals of the shafts.

Plate 32a, shews two other designs for mural monuments, giving plan and elevation respectively; and in *Plate 37b,* is another with its detail—

Fig. 1, in the latter, being a section through the arch-mold;

Fig. 2, a section through the capitals of the columns;

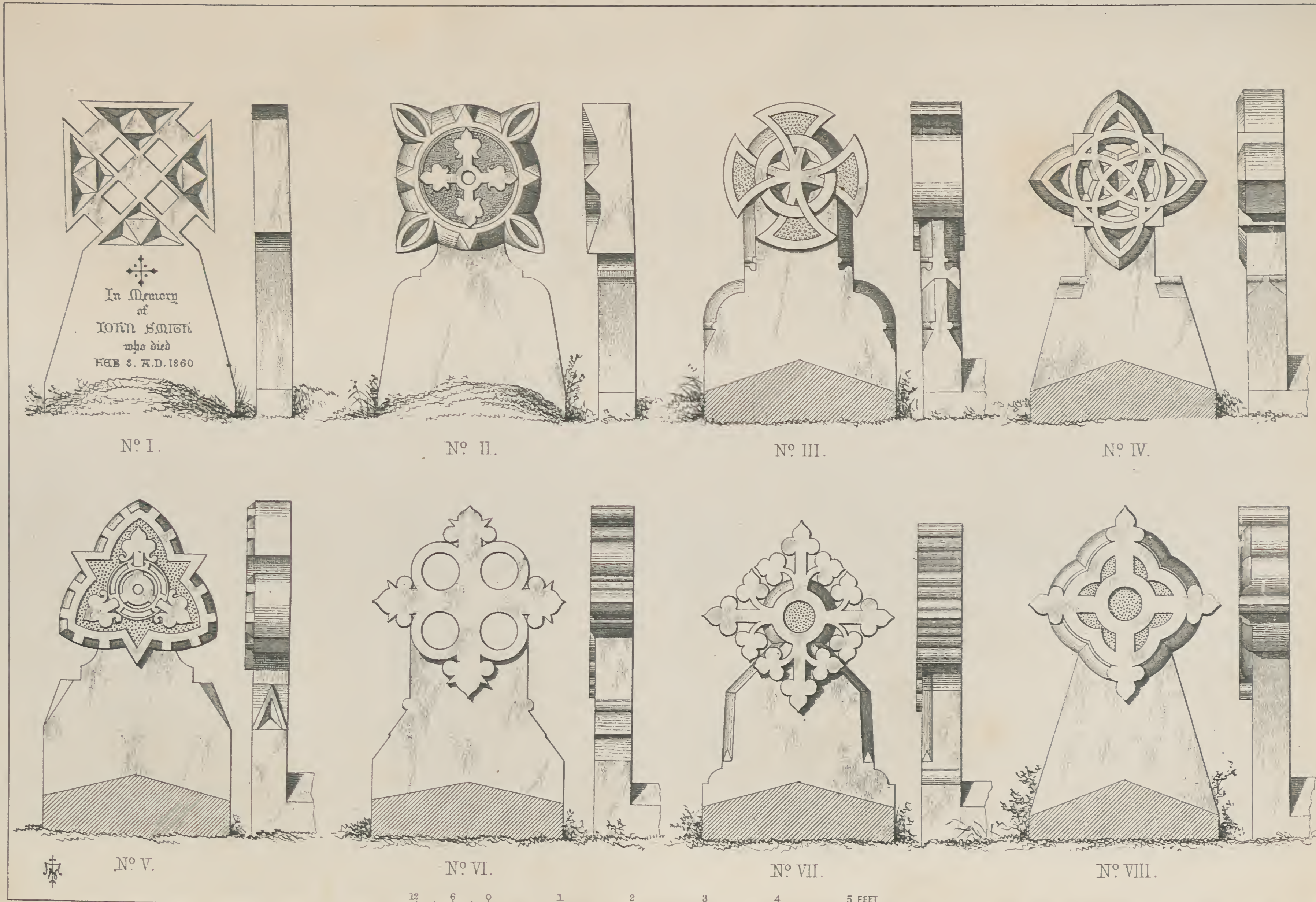
Fig. 3, a section of the base of the latter; and

Fig. 4, a section through the lower molding of the corbel which supports the columns.

It may be observed here, while speaking of mural monuments, that the head-stone attached to the coffin-shaped or coped tomb, given in *Plate* 36, would, separated from the latter, make a good design for a tablet memorial, only requiring, if used as such, a base or string of a similar kind to that of the design given in Plate 33. The line of the wall against which it should be placed would in this case be the back line of the section, *Fig.* 4 in the Plate, by which means the crowning finial would be still left in full detachment, as would the shafts and all the features of the side return, shewn in *Fig.* 8.

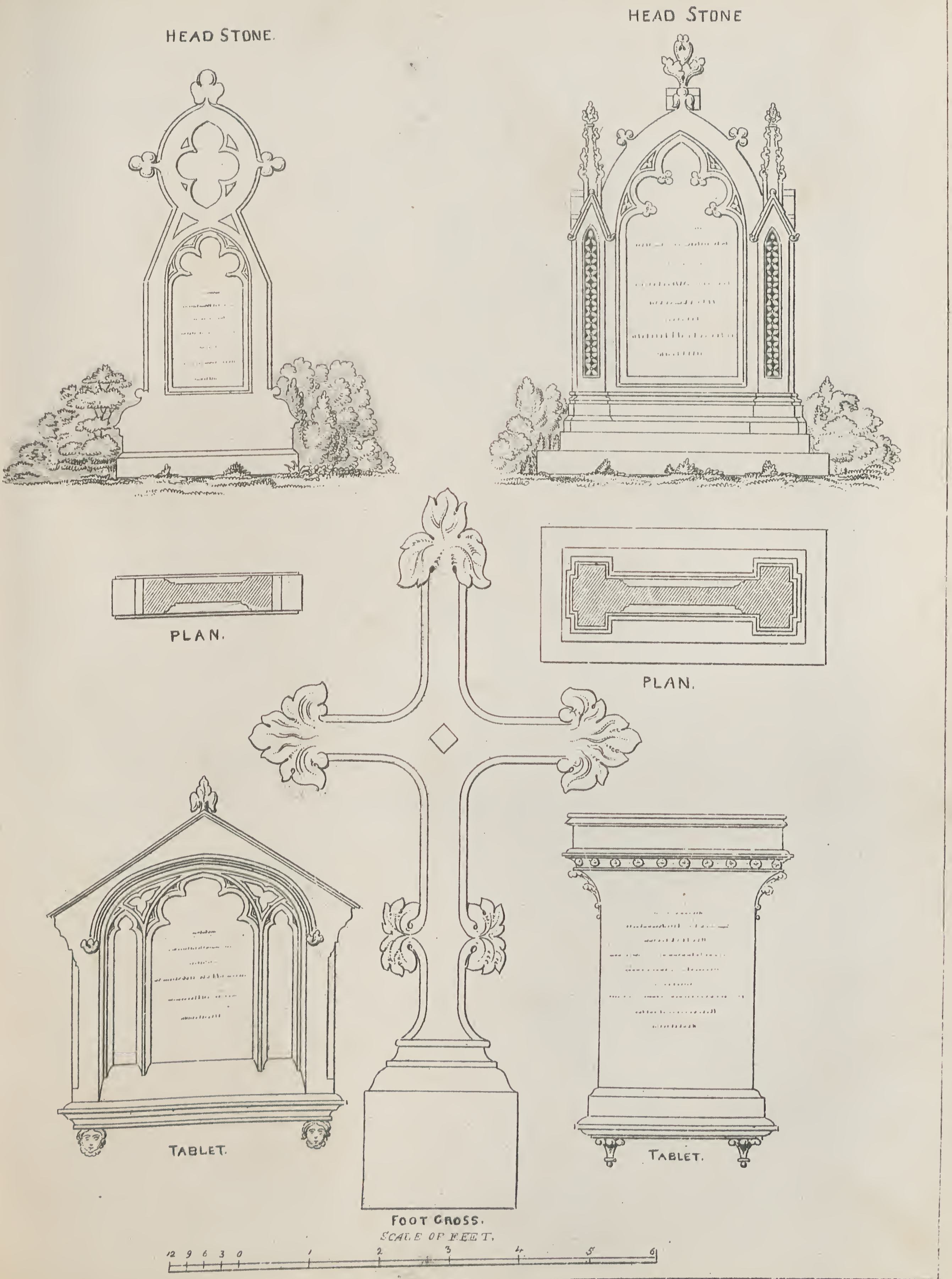
We now come to the last of the eight before-mentioned forms of tomb, comprising detached buildings, obelisks, columns, &c.; to which we may add a number of other varied shapes. Among the latter, as having lately received particular attention, may be noticed head and foot-stones, or, as they are entitled in *Plates* 35 and 37, where we give a variety of designs for the

GRAVE - STONES.

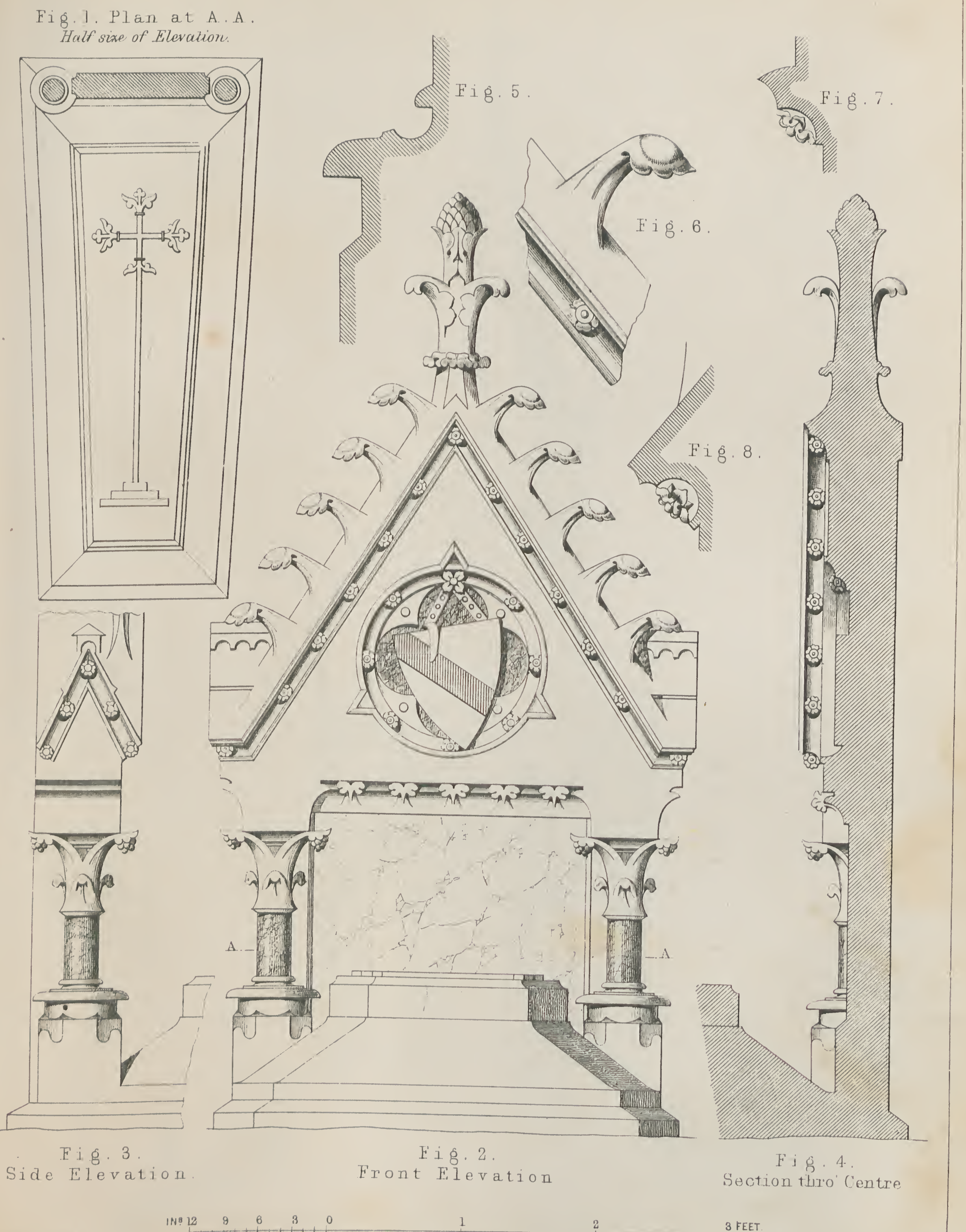


J.R. Jobbins.

HEAD STONES, TABLETS &c.



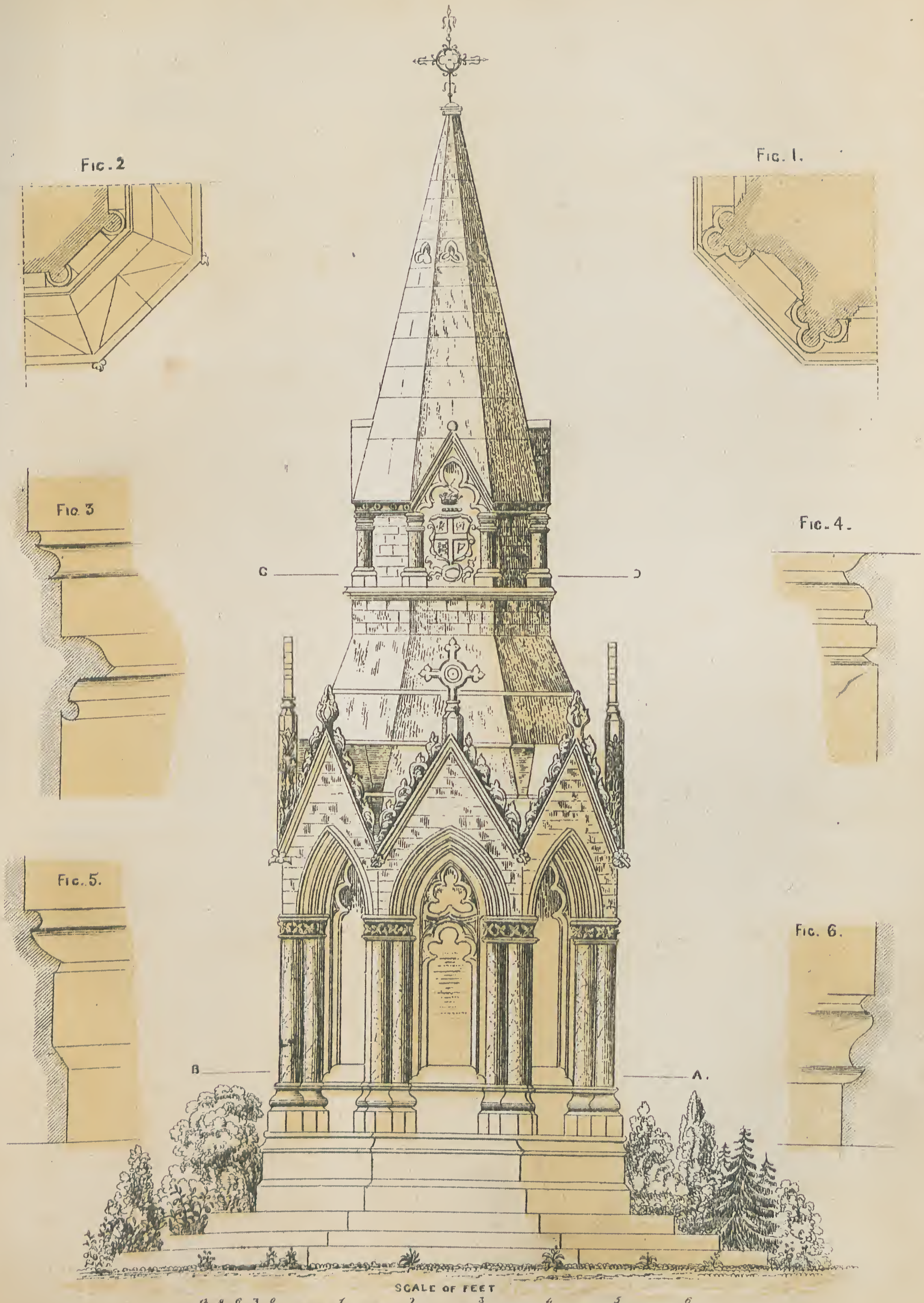
DESIGN FOR A GRAVE STONE-GOTHIC.

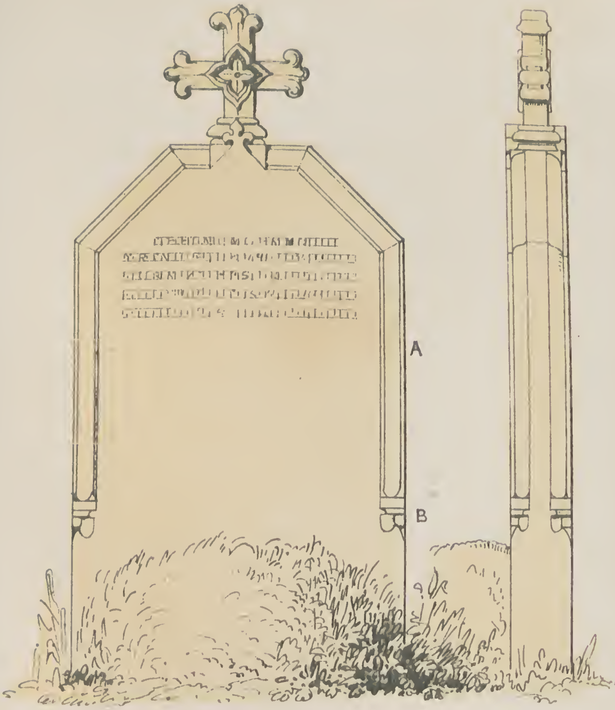


Blackburne, del. J.R.Jobbins.

London. James Hagger, 67 Paternoster Row

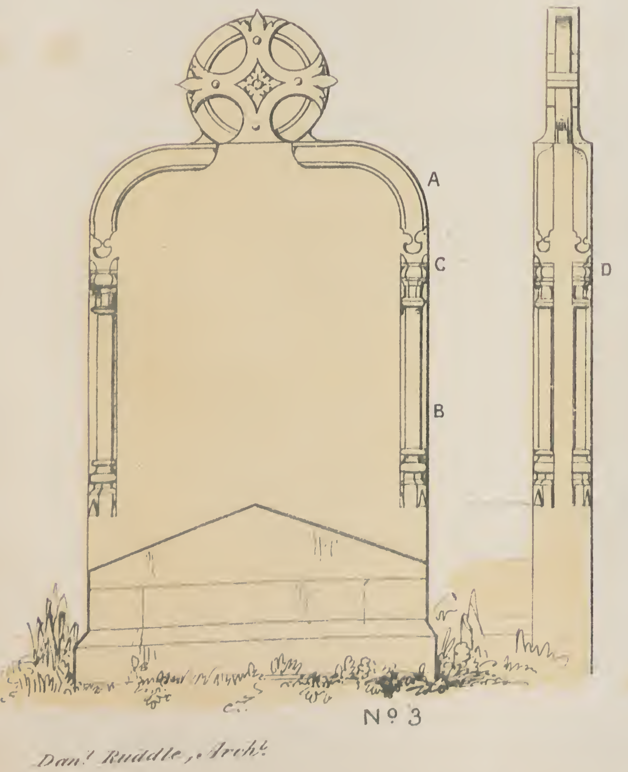
A CEMETERY MONUMENT.





Nº 1.

Nº 2



Nº 3

Nº 4

Danl Ruddle, Archt.

London, James [illegible] Paternoster Row

same, gravestones and cemetery memorials. Up to late years, as remarked in the first part of our observations on the subject in hand, very little, in some cases nothing, more than a mere plain upright slab of stone, with an inscription detailing the name and age of the departed person buried below, accompanied, perhaps, by a few commonplace verses, was the prevailing, if not the universal, memorial of the ordinary dead seen in our churchyards and other burial-places. Occasionally a table tomb of pseudo-Classic taste, surrounded by its iron enclosing rail, or an obelisk, or a broken column, or an urn, marked the last resting-place of some richer and therefore more favoured mortal; but anything like the more appropriate substitutes—as less pretending than the last, and better in taste or character of design than the first,—which have lately appeared, were not to be found. Happily the expressionless appearance of the older have been to a large extent, as previously observed, realised, and a walk through many of our cemeteries and burial-grounds will now shew a more correct appreciation of the beautiful and fitting, even though it be applied to so simple, or, to the many, so uncared-for a thing as a grave. "Grave on my grave," it has been pithily said,

> "Some sentence grave and terse,
> That *lies* not as it lies upon my clay."

and the present day is disposed to carry out a parallel sentiment, at all events to the extent of a larger consideration than formerly, of what is the fitting characteristic and expression to be observed and retained in these cases, and which, it is now generally admitted, should in a fuller measure gratify the eye, and materially as well as more especially represent the sign and hopes of the Christian dead.

In *Plate* 35 are given eight different designs for cemetery or grave memorials of the head-stone kind.

Figs. 1 and 3, are of early character.

Figs. 2, 4, and 5, somewhat less so, partaking of that seen in Early English ornamental forms.

Figs. 6, 7, and 8, are later.

Each, as will be seen, shews a front and a side elevation of the headstone, the coped stone covering of the grave being indicated in six of them, and the simple heaped and turfed grave in the first two.

Some of these designs have been executed, and are very pleasing. *Figs.* 6, 7, and 8, are pierced, as is also *Fig.* 4, in part; the rest have solid heads.

In *Plate* 37, we give four other designs for gravestones of the same description, each consisting of a front and side elevation, as in the last cases, with which they also agree to the extent of exhibiting in two of them, *Figs.* 1 and 2, the heaped mound over the grave, and in the other two, *Figs.* 3 and 4, the coped stone. The drawing will sufficiently shew the treatment observed in these examples, and the nature of the ornament employed. For the detail of their molding, &c., we refer the reader to the Plate of Details, 37*a*, where that distinguished as

Fig. 1, shews a section through the molded edge of the stone at A, on the elevation represented as No. 1, with an elevation at large of the manner in which the same is stopped and chamfered off at B on the same figure.

Fig. 2, shews, in like manner, a section through the molded edge at A, and the terminating ornament of the same at B, on the elevation No. 2.

Fig. 3, shews sections through the molding, &c., at the two points, A and B, of the elevation No. 3, with enlarged representations of the front and edge at C and D, shewing the termination of the molding above, and the caps, &c., of the attached shafts which are formed here; and

Fig. 4, exhibits a sectional cut through, at A, and an enlarged view of a portion of the ornamented edge of the head of elevation, No. 4.

Following up the same kind of illustration, *Plate* 38, contains also two designs for gravestones, similar to those in the last described. Of these—

Figs. 4 and 5, are the front and side elevations, with their respective plans, taken in the one case at A A, and in the other at B B, on the elevations. Both these latter, as will be observed, are in connexion with a coped or stone-covered grave. The terminating cross of *Fig.* 4 is pierced. The ornament on *Fig.* 5 is in relief of the solid, and in part surrounded by a piercing, as shewn more at large in the Plate of Details 37*a*, before referred to, where we give also enlarged parts of *Fig.* 4, and details of *Fig.* 1, which forms the centre subject of the *Plate* 38.

This latter professes to be a design for a cemetery, or other externally situated, monument, in the shape of a raised cross, which may be classed, perhaps, with those of the obelisk description. In the middle age, this form of monument was a favourite one, and a few remains of the more general and less ornate of them, with some of the richer, are still to be seen. The memorial crosses erected in remembrance of Eleanor, wife of Edward I., are well known examples of the latter, and in particular that of Waltham, in Herts, which has served as the basis of the idea for the Martyrs' Memorial, erected a few years since at Oxford.

Fig. 1, shews the elevation, which represents an octagon shaft and base, raised on three degrees or steps, supporting a cross, the arms of which are connected by an open or pierced quatrefoil, enclosed within a circle.

Fig. 2, is the half plan of the base, taken at D D on the elevation; and

Fig. 3, a like half plan of the shaft at C C.

The details, or parts at large, are given, as before observed, in the *Plate* 37*a*;

Fig. 5, therein, being a portion of the quatrefoil of the head, with a sectional cut through its outer rim or circle.

Fig. 6, is the molding of the base of the cross, and an idea for enriching the foliations of the arms, if desired.

Figs. 7 and 8, are the details also, or parts at large, of the two other figures given as *Figs.* 4 and 5 in *Plate* 38, and referred to above; the first, or *Fig.* 7, being an elevation of a portion of the lower part of the pierced cross or head of the gravestone numbered 4, to an enlarged scale, with the section of its molding; and *Fig.* 8, a portion of the upper part of the gravestone marked 5, with its ornamentation also enlarged, and a sectional cut shewing the relief of the latter.

FIG. 1.

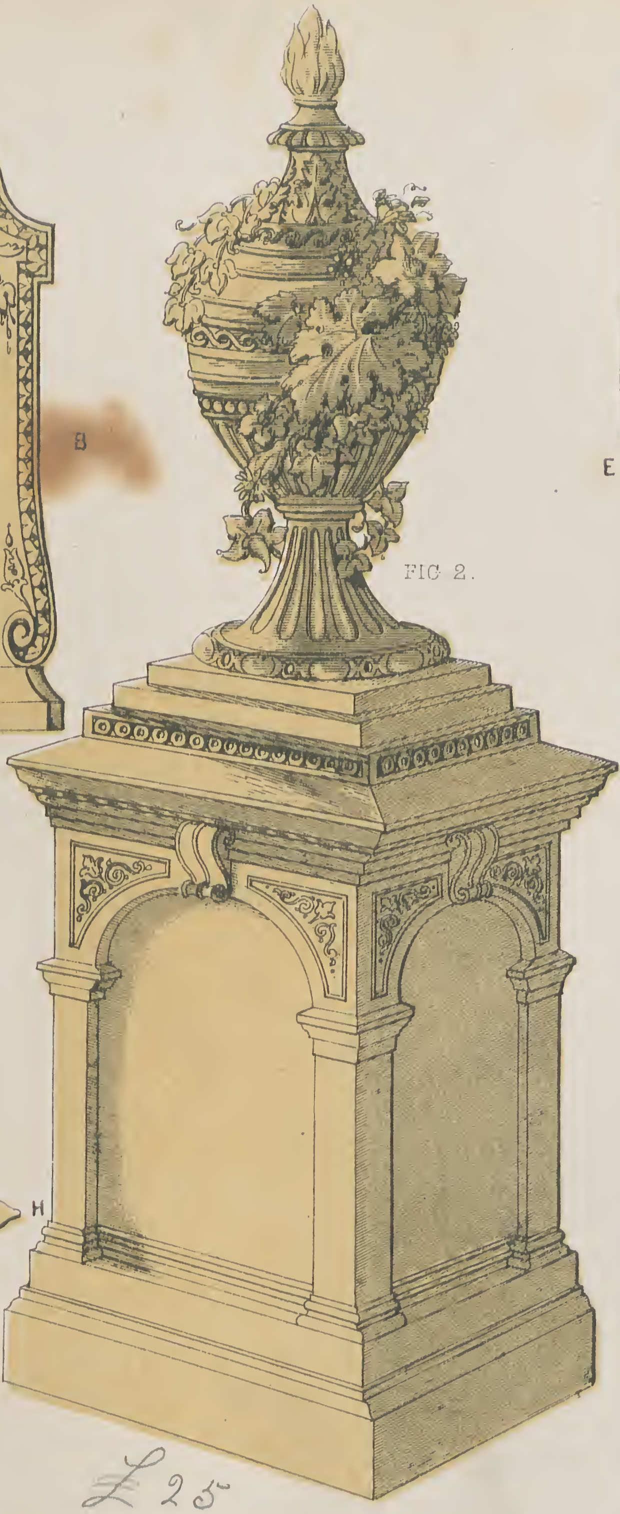


FIG. 2.

£ 25

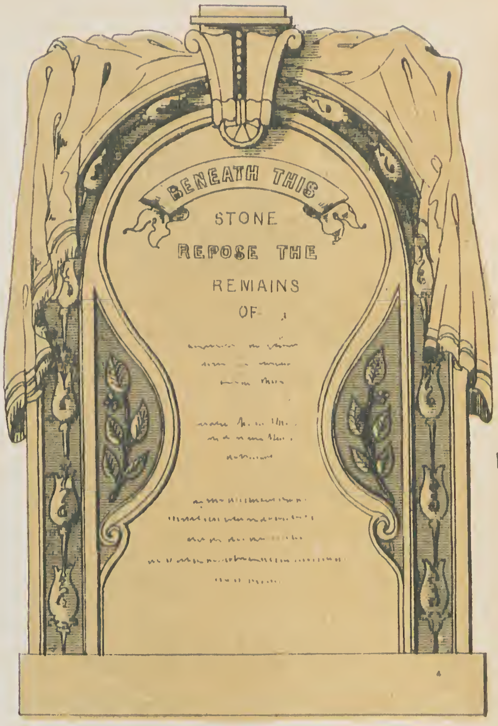


FIG. 3.

FIG. 4

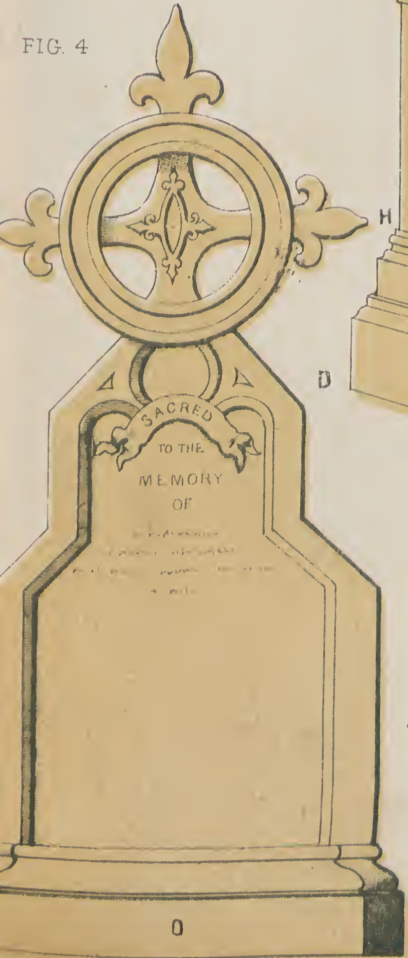
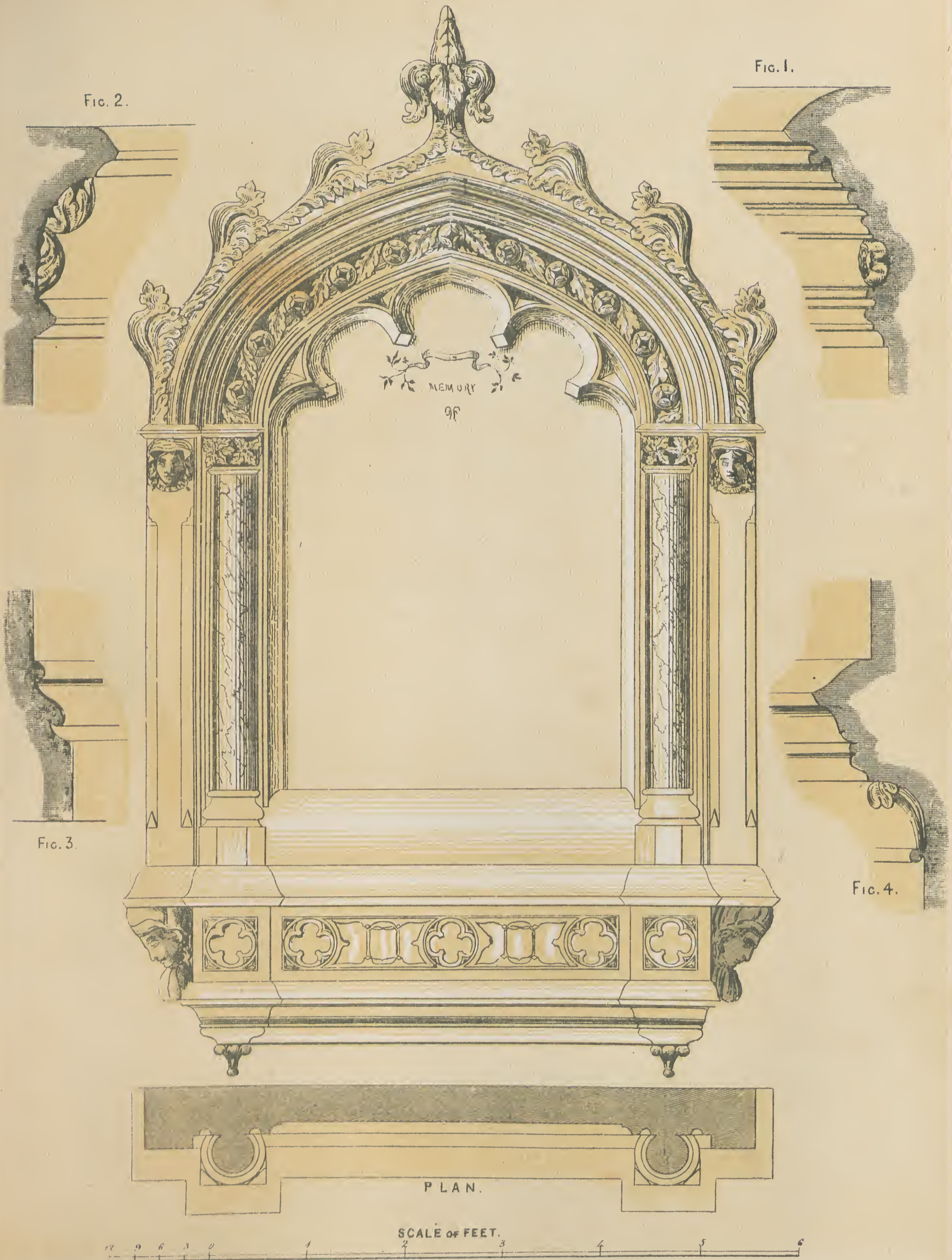


FIG. 5.

SCALE OF FEET
0 1 2

A MURAL TABLET.



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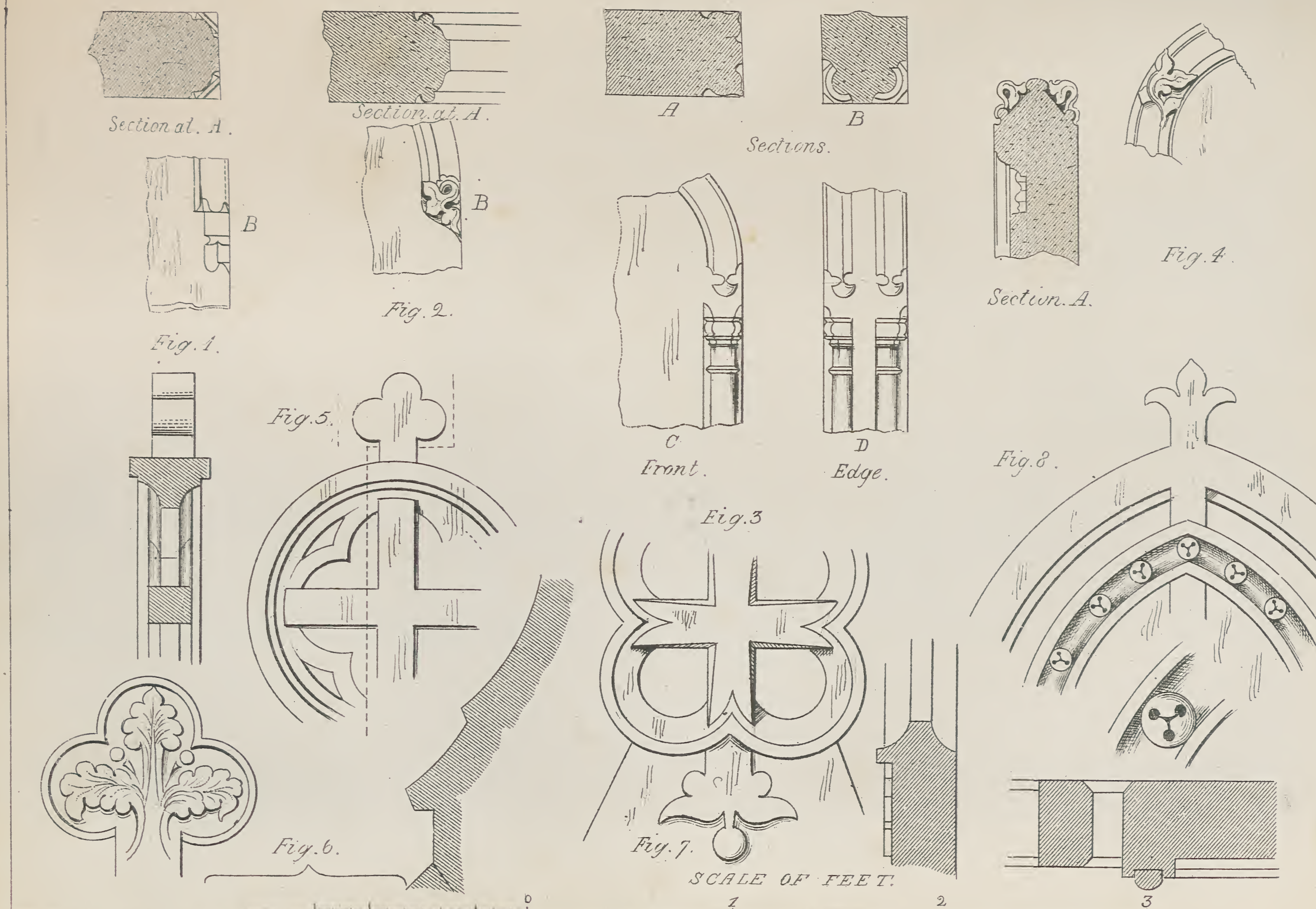

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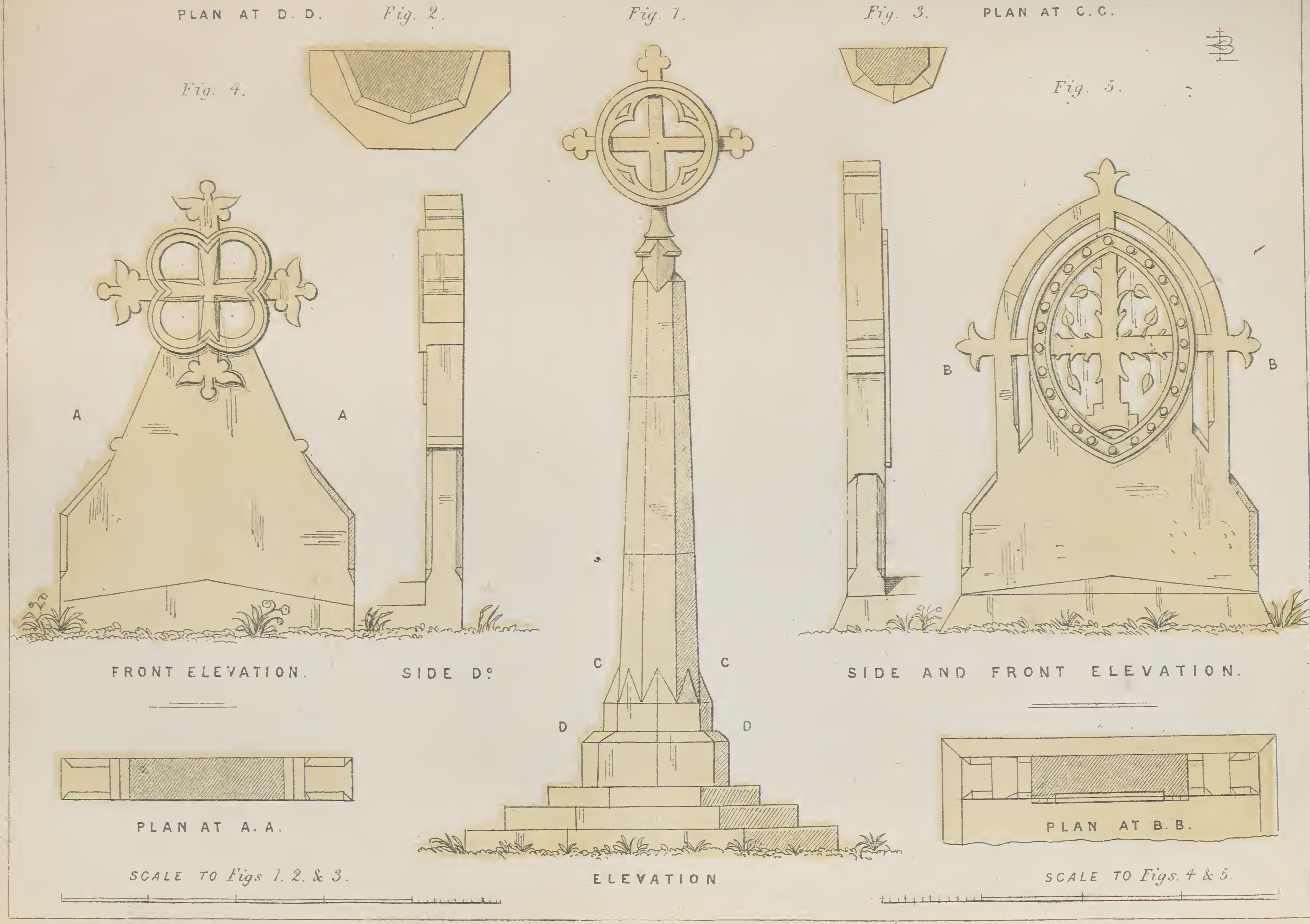
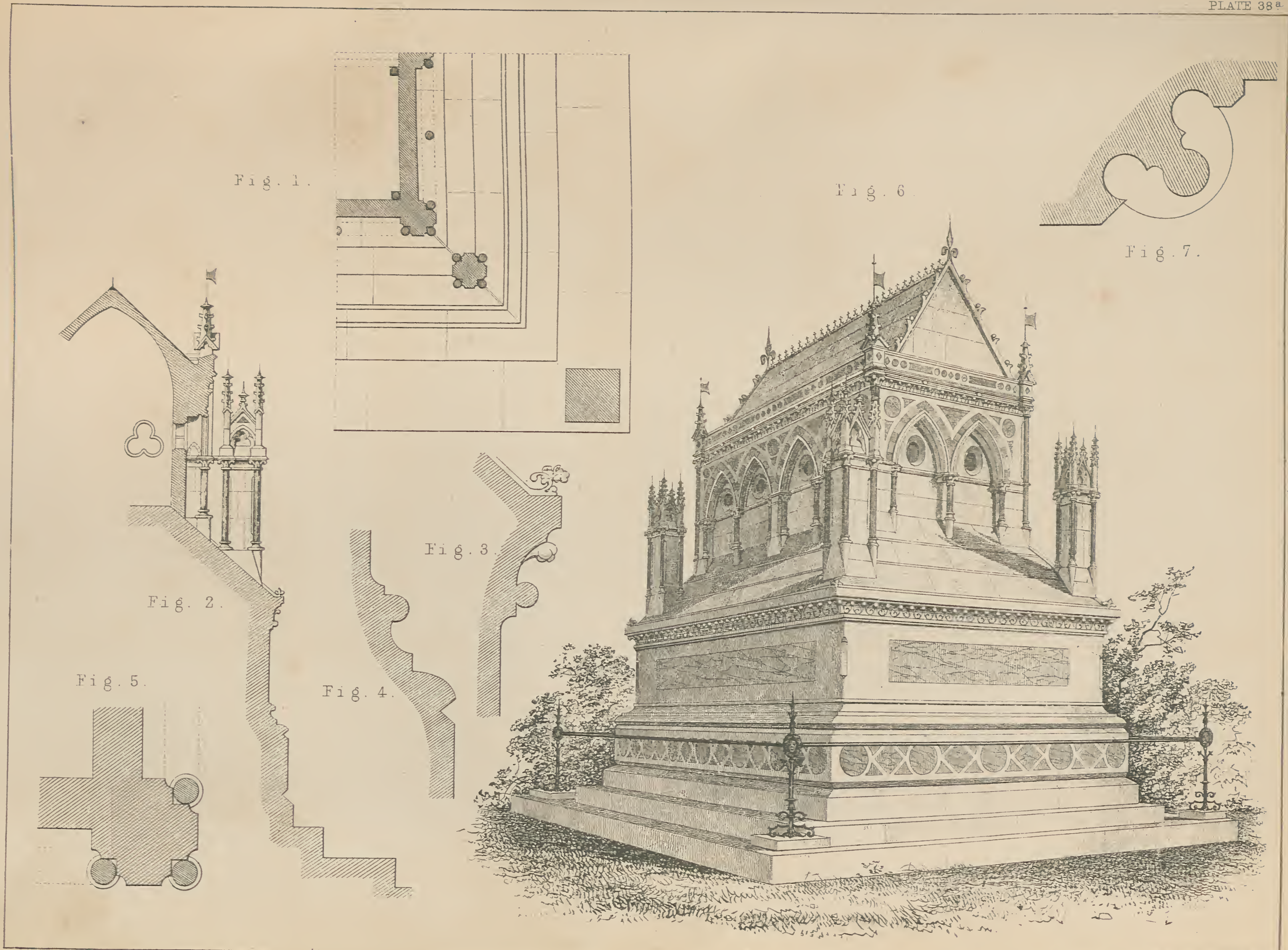

PLAN AT D. D.
Fig. 2.
Fig. 1.
Fig. 3.
PLAN AT C.C.
Fig. 4.
Fig. 5.
A
A
B
B
C
C
D
D
FRONT ELEVATION.
SIDE D°
SIDE AND FRONT ELEVATION.
PLAN AT A. A.
PLAN AT B.B.
SCALE TO Figs 1. 2. & 3.
ELEVATION
SCALE TO Figs. 4 & 5.

DESIGN FOR A TOMB - ITALIAN GOTHIC



E.L. Blackburne, del

Of a similar kind of monument to that of the raised cross just described, we also give another illustration in *Plate 36a.*

This, as respects its general design, approaches more nearly than the preceding, to those of the type just mentioned as erected at Waltham, Tottenham, Geddington, and other places, to the memory of Queen Eleanor. It is, as will be seen, like the two last-named, and the generality of other examples, octagon on plan, each of its lower faces being decorated with arches, having above them gabled terminations enriched with crochets and finials. The upper stage has smaller gables on the four cardinal sides, and above this the monument finishes as a spire, with a metal cross, crosses being also the terminating ornament of the four tower gables whose faces correspond with those which are gabled above. The recesses in the lower stage are designed for the inscriptions, and the whole erection is based (see elevation) upon three degrees or courses of steps.

Fig. 1, is a quarter plan of the lower stage, taken on the line A B, shewing the recess of the faces, and the clustered columns of each angle.

Fig. 2, is a like quarter plan of the upper stage, taken along the line C D.

Fig. 3, is a vertical section through the base of the shafts, at the angles of the upper stage, and of the cornice or string beneath the same.

Fig. 4, is a similar section through their caps.

Fig. 5, is a section of the base-mold and plinth; and

Fig. 6, a section through the base of the shafts at the angles of the lower stage.

These shafts are proposed, as shewn in the elevation, to be formed of native or other marble, as are those of the upper stage; the rest of the monument in stone.

In concluding our observations on tombs, we will give one other design, which may be taken as being of the description included in the term "detached buildings," the first mentioned of Gough's eighth, and last form, though it is also, with equal propriety, to be classed among tombs of the altar kind.

This design (see *Plate 38a*) is calculated perhaps more especially for exterior application, as are the two last given, though the shrine-like character of the upper portion is one frequent in interior tombs. The particular phase which it exhibits is that of the Italian Gothic, and its principal forms and enrichments are aided by the introduction of marble and other coloured insertions. The general idea, as will be seen, is that of an oblong substructure of the altar kind supporting a roofed tomb, the sides and ends of which are arcaded beneath a sculptured cornice, from the four corners of which pinnacles rise from as many angle shafts, ornamented with carved capitals resting on the base of the upper part, the arches below the cornice being supported on similar attached and detached columns, also issuing from the upper base. The gables are crocketted, and the ridge has an ornamental cresting. The cornice of the substructure is richly carved, and from it the stonework slopes or tables back to the lesser size of the upper portion of the tomb, its angles being terminated or finished with turrets capped with gablets and pinnacles, the latter rising from angle shafts in the same manner as the pinnacles of the upper part. Beneath the cornice of the lower part is the die or dado, pannelled in marble, and resting on a bold base-mold, the plain face of which is enriched with a corresponding inlay

of coloured marble in patterns. The whole rests on two ranges of steps, the lower of which supports the standards for an enclosing rail. In connexion with the marble introductions here suggested, the shafts would of course be of correspondingly rich material, such as serpentine and other of the richer coloured materials now frequently employed. The carved parts would be executed in free-stone or alabaster, and the rest in the best Bath or other good local stone. It is unnecessary to say that the same form might be adopted, and the enrichments derived from the marbles omitted, but this would be probably at the sacrifice of much of its proper character and effect. It is possible, however, that, executed in Caen stone, with coloured stone for the arches, and Purbeck or some of the Devon or Cornish marbles for the shafts of the columns, it would still make an effective object.

Fig. 1, in the Plate, shews a quarter, or one-fourth, of its plan, taken through the upper portion of the monument, above the slope or tabling of the lower part, and below the caps of the columns, both of the upper structure and of the angle turrets.

Fig. 2, is a vertical section taken transversely through a portion of the tomb, shewing its geometrical contour, and the side elevation or face of one of the angle turrets in connexion.

Fig. 3, is a section through the cornice of the lower part, or substructure, of the tomb; and

Fig. 4, an enlarged section of its base-mold.

Fig. 5, is an enlarged plan of the angle of the upper tomb, shewing the position, &c., of the connected shafts.

Fig. 6, is a perspective representation of the tomb entire; and

Fig. 7, an enlarged section of the arch moldings.

CHAPTER XVII.

STAIRCASES.

Staircases practically are communications between the stories of buildings. Few architectural features are of more utility and importance, particularly in modern construction, or admit in a more eminent degree of decorative effect, whether by means of the proper proportioning of the necessary parts, or by the introduction of sculpture and painting.

The chief requisites of staircases are, that the communication should be easy, obvious, and ready; that their strength should not only be real, but also apparent; so as not, however secure, to seem fragilely suspended, but to convey at a glance a satisfactory feeling of security; and thirdly, that the light should be clear, there being less error in any excess than in a deficiency. "Staircases," Palladio observes, "will be perfect if they are spacious, light, and easy to ascend, as if, indeed, they seemed to invite people to mount. They will be clear if the light is bright and equally diffused; and they will be sufficiently ample, if they do not appear scanty and narrow in proportion to the size and quality of the building. They will be

convenient with respect to the whole building, if the arches under them can be used for domestic purposes; and commodious for the persons going up and down, if the stairs are not too steep, nor the steps too high."

The position of staircases, with reference to the various apartments and the approaches and passages of edifices, is a matter of considerable importance. Some architects advocate that they should be visible from the principal entrance, so that there should be no hesitation in the mind of one entering the structure as to the means of approach to the upper floors. At the Reform Club House, the late Sir Charles Barry followed a different system. Beyond the vestibule there is here a noble atrium, court, or hall, amply lighted from above, and the staircase—which, by the way, deserves careful study from its admirable decorative effect—is placed at one side of the atrium, and is partially concealed. Considering, however, the opportunity which a staircase affords, in extensive structures, for architectural effect, we incline to the idea that it should, as a general rule, be made the most prominent feature near the entrance, ample ventilation and light being also thus secured, although in the case of the Reform Club House these ends are attained by means of the atrium. The author before cited remarks, that care should be taken in the arrangement of the staircase that no part of the building should be anywise prejudiced by it. "There are three openings necessary," he says, "to a staircase. The first is the doorway which leads to it, which the more it is in sight the better it is; and I highly approve of its being in such a place, that before one comes to it the best part of the house may be seen; for although the house be small, yet by such arrangement it will appear larger: the door, however, must be obvious and easy to be found. The second opening is that of the windows through which the stairs are lighted; they should be in the middle, and large enough to light the stairs in every part. The third opening is the landing-place, by which one enters into the rooms above; it ought to be fair and well ornamented, and to lead into the largest places first."

That great size is not requisite to secure architectural effect in staircases, is evident from a remarkable example by Inigo Jones, in one of the collegiate buildings adjacent to Westminster Abbey, in which a striking and almost imposing result is obtained in a limited space. Sir John Soane thought so highly of this design, that he had a series of accurate drawings made of it, to illustrate his lectures at the Royal Academy of Arts.

The ancients do not seem to have appreciated the importance of the decorative effect which may be given to staircases; but these, it must be conceded, were little employed by them except for subsidiary purposes. Vitruvius is almost silent on their architectural arrangements. The best preserved Grecian and Roman examples are those which were constructed in the thickness of the walls of temples, in order to ascend to the roofs. Few of the houses at Pompeii had a story above the ground floor; and the staircases of those which were provided with upper stories were, in all probability, mostly constructed of wood: these were evidently narrow, inconvenient, and almost destitute of decoration. During the middle ages, it seems to have been the most usual practice to place staircases, if of large size, outside the building, those within being generally winding and incommodious. It is not until the close of the sixteenth century, when Italian features were revived, that internal staircases of a decorative character were introduced in England: many of those erected in the seventeenth century are at once com-

modious and imposing. Bernini's celebrated staircase, in the Vatican at Rome, had no equal of previous erection, and has scarcely been surpassed, in calm nobility of expression, by subsequent designs.

With reference to the parts of staircases, the *tread* is the horizontal and the *riser* the vertical part, together forming each step or stair. The front edge of the tread, above the riser, is called the nosing, and it is either plain and square, or moulded in various ways; and sometimes the moldings are returned round the end, which is also often sunk and finished with decorative forms. *Flyers* are straight steps of uniform width on plan; and *winders* are radiating steps, triangular on plan. *Quarter* and *half spaces*, or paces, are resting-places occupying respectively the length of a step square on plan, and the whole width of the space of the width of the two flights of stairs by the length of a step, and similarly modified in cases of curved plans. They are sometimes called *landings;* but this term applies strictly to resting-places leading to apartments. It may be observed that, as a general rule, there should not be more than ten or twelve steps between each resting-place, as Palladio observes, "thus to help weak people, and of short breath, as well that they may there have the opportunity of resting, as to allow of any person falling from above of being there caught." The outer end of the bottom step is sometimes made of a spiral form, and it is then called a *curtail* step: *quarter rounds* are often adopted. The *flights* are the sets of steps leading to the resting-places; and *staircase* applies to the whole of the parts collectively. The central space between the parallel flights on plan is called a *well-hole*, or *open newel:* if closed, it is a *solid newel.* The *balustrade* is the protecting parapet supporting the hand-rail: *balusters* are small columns, or posts, forming an open balustrade, which is, however, often solid, or turned in various decorative shapes. Scroll-work in iron and other metal is frequently introduced, particularly in the case of the open well and returned nosings.

The plans of staircases are very various—circular, elliptical, rectangular, and at all angles. Generally they may be divided into three kinds: viz., those with open, or solid newels, the open well, and *dog-legged* stairs, which latter have no well, the balustrades of the successive flights being in the same vertical plane, and stopped by the soffit of the upper flight, except where the steps commence or terminate. *Plate* 39 illustrates the different kinds of staircases.

Figs. 1, are a plan and section of an open newelled staircase, square on plan, lighted at the side, and also by a skylight above.

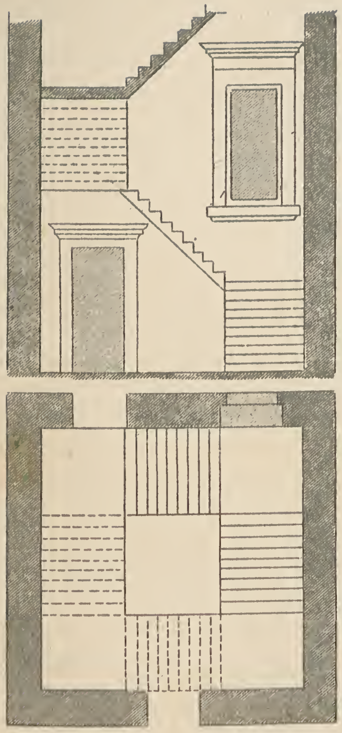
Figs. 2, are a plan and elevation of a solid newelled staircase, square on plan, lighted at the side.

Figs. 3, are a plan and elevation of an open newelled staircase, circular on plan, with niches at the sides, diminishing the thickness of the wall, and lighted from above.

Figs. 4, are a plan and elevation of a solid newelled staircase, circular on plan, and lighted at the sides. The newel in this example, as also in *Figs.* 2, may, of course, be filled up inside, instead of being constructed in the form of a wall. Where the newel is very small, only a few inches, the ends of the steps are worked to form it, and iron dowels, or a continuous vertical bar, inserted. Where the newel is large, and desired to be closed, a wall is erected.

Fig. 5, is a plan of an open newelled staircase, of elliptical form, lighted from above.

Fig. 6, is the plan of a dog-legged staircase, lighted from above, and at the ends.



FIGS. 1.

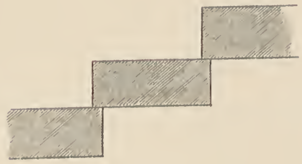


FIG. 7.

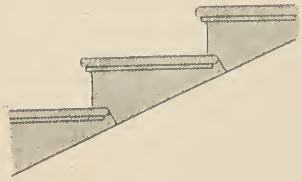


FIG. 8.

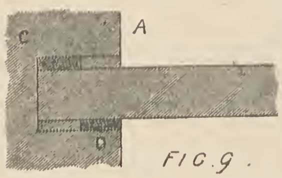
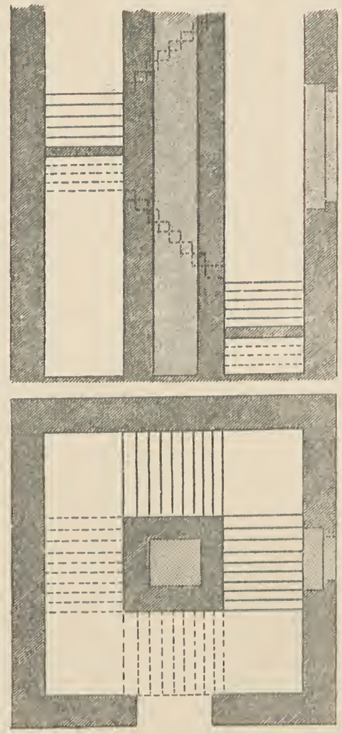
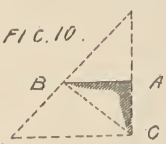


FIG. 9.



FIGS. 2.

FIG. 10.



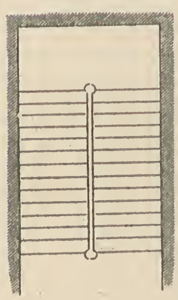
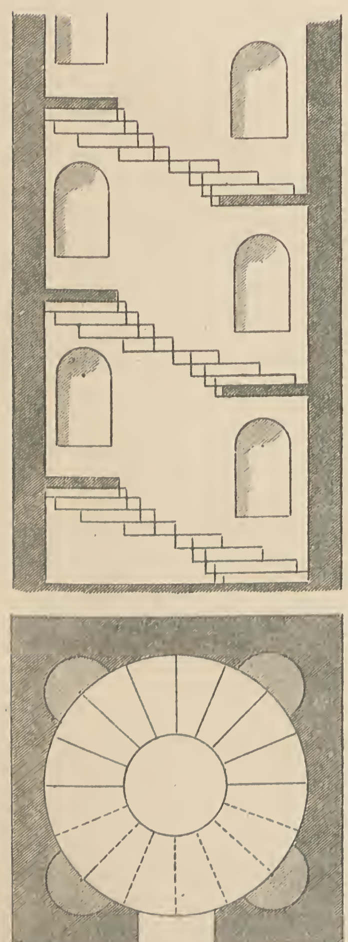


FIG. 6.



FIGS. 3.

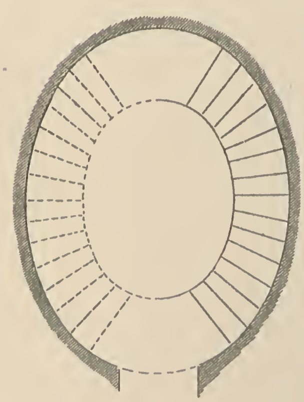
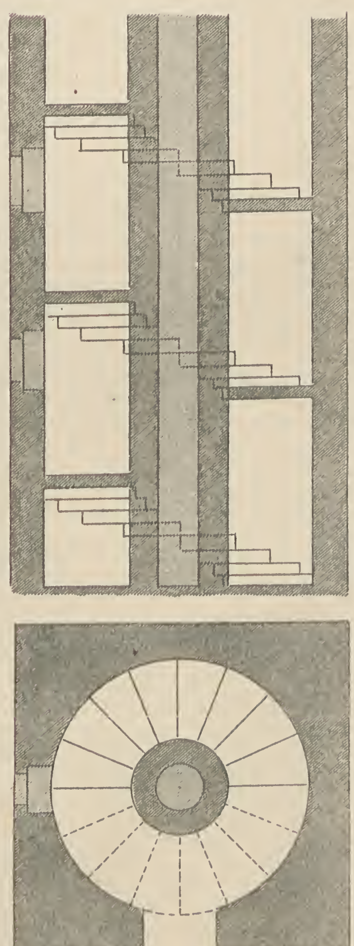


FIG. 5.



FIGS. 4.

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Open newelled staircases, as in *Figs.* 1, 3, and 5, are sometimes called *geometrical* staircases.

Figs. 7 and 8, shew the manner in which the steps are supported in the direction of their length. In *Fig.* 7, the steps are solid; and one should rest on the other from an inch to an inch and a half. They are usually tooled or rubbed, and back-rebated for the upper steps. In *Fig.* 8, the soffits are weathered, and the joint is usually of the form shewn, when only one end of the step is fixed in the wall, preventing the step descending either vertically or in the inclined direction of the stairs. The joint on the lower part of the top step is called a *back rebate,* and that on the upper part of the lower step an *interior rebate,* the joining being a *joggle.* The width of the horizontal part of the joint may be about an inch; and the angular portion of the joint should be perpendicular to the soffit line, and of a depth proportioned to the strength of the stone. Usually two inches for steps four feet long is a safe thickness, measured perpendicularly to the rake. A thickness of half the number of inches that the step has feet in length, is a good rule.

The ends of the steps are housed, or let into the wall, from four to nine inches, according to their length, as shewn in *Fig.* 9, A. being the face of the wall, and B. the step, which, if weathered below, should be let solid into the wall, thus insuring additional strength. It is obvious that the leverage induced by the weight of the step itself, and an additional load placed upon it, will act, in the first place, at the two points on the upper and lower surfaces, C. and D., tending to raise the superincumbent part at C., and to depress the lower support at D.: a less force then at the extremity C., and a less support at the extremity D. than at any other points, will be required to sustain the stone; and, consequently, great care should be taken to secure an effectual resistance at those points.

Landings and half and quarter spaces are to be similarly let into the walls. They are often about six inches in thickness; or they are made of the same thickness as the steps at their deepest part. When so large as to require two or more stones, one is set on, or joggled, as before described, to the last step, and the next stone is joggled to the part first set, and run with cement, and so on with each stone in succession. The usual practice in the case of the last mentioned, is to joint by means of what is called a male and female joggle, which means that the edge of one stone is grooved throughout its length, and the other worked with a tongue or projection, which shall fit this groove. The ends of steps pinned into walls, and also those of landings, should be set in cement.

Dog-legged staircases present no difficulties in construction which will require further illustration. In some kinds of staircase, however, portions are quite independent of the side-walls, as when, in addition to the side flights, there is one in the centre. In the case of a solid intermediate string, or newel, between the centre and side flights, this creates no difficulty, as the ends of the centre flight are let into the enclosing walls or solid newels. In that of the open well, with the returned nosing and ornamented side of the step, the same practice is followed as in the case of the geometric stair, one end of which is inserted in the wall, with the difference that here both sides are treated in the same manner as that which in the former is not inserted, the joggled lodgment of each step on the other, acting as sufficient support in con-

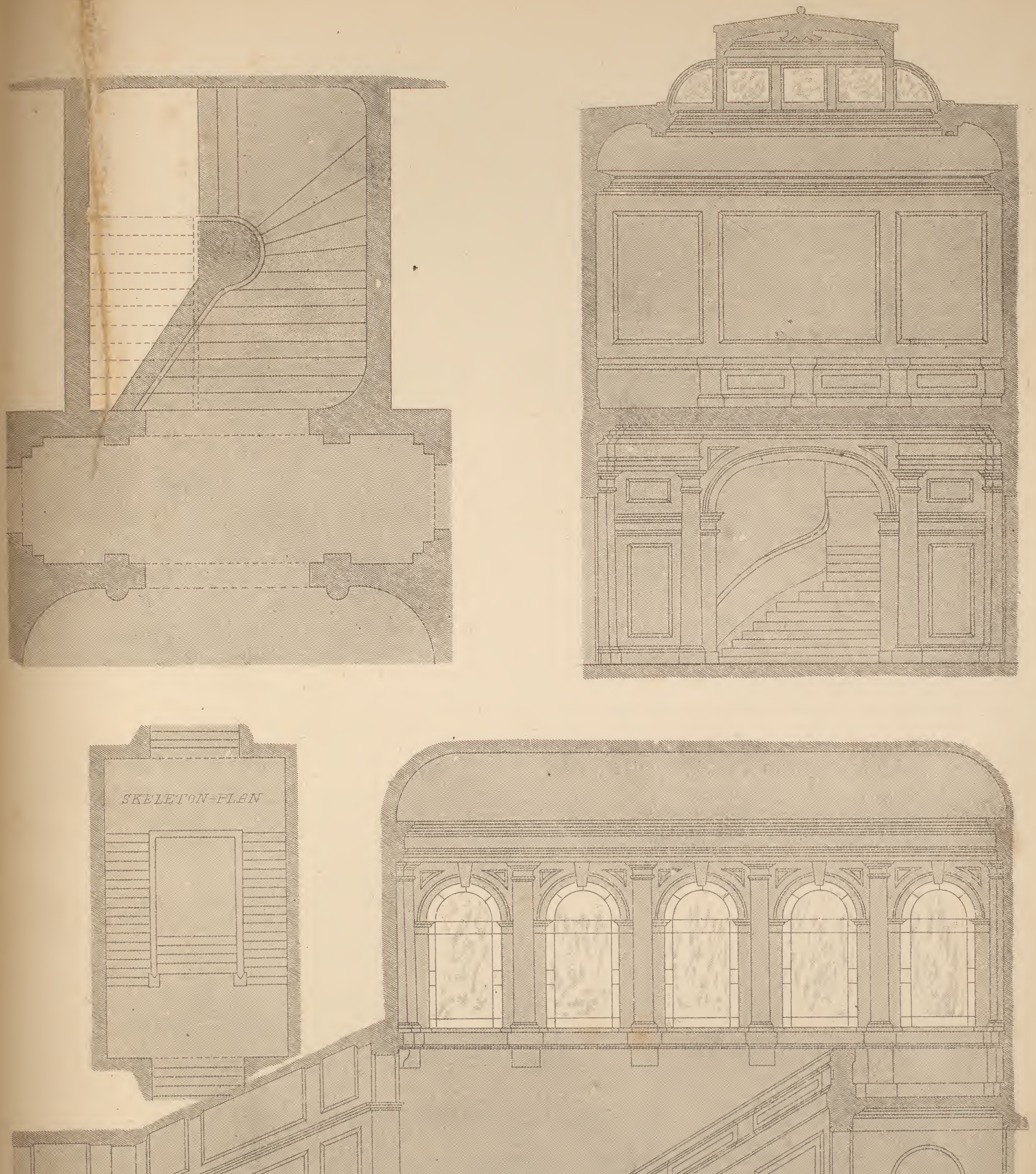
nexion with the firmly fixed bottom step, in these instances usually solid, and the landing or half pace above.

The proportion between the width of the tread and the height of the riser requires in all staircases particular attention. A rise of five and a-half to twelve inches is a very good ratio. Usually, in practice, superior staircases are constructed with treads from twelve to fifteen inches wide, and risers from four to six inches high. Treads ten inches wide, and risers seven inches high, are commonly adopted for inferior staircases. Palladio says:—" The steps ought not to exceed six inches in height; and if they be lower, they must be to long and continued stairs, for they will be so much the easier, because one needs not lift the foot so high; but they must never be lower than four inches. The breadth of the steps ought not to be less than a foot, nor more than a foot and a half. The ancients used to make the steps of an odd number, that thus beginning to ascend with the right foot, they might end with the same foot, which they took to be a good omen, and a greater mark of respect so to enter a temple."

Fig. 10, illustrates a simple geometrical method of proportioning the width and height of steps. The right-angled triangle being drawn, if either A B or A C is fixed upon as the width, or height, one gives the other: B C is the line of inclination. Of course, in settling the number of steps, care must be taken to preserve sufficient headway under the return flights above. We add Blondel's formula for proportioning steps of easy ascent:—" If a person walking upon a level plane, move over a space P, at each step, and the height which the same person could ascend vertically, with equal ease, were H; then if h be the height of a step, and p its width, the relation between p and h must be such, that when $p = \mathrm{P}$, $h = o$; and when $\mathrm{H} = h$, $p = o$. These conditions are satisfied by an equation of the form of $h = \mathrm{H}\left(1 - \frac{p}{\mathrm{P}}\right)$." Blondel assumes 24 inches as the value of P, and 12 inches as that of H; and substituting these values in our equation, it becomes $h = \frac{1}{2}(24 - p)$, which is precisely Blondel's rule. We do not consider these the true values of P and H,—indeed, it would be difficult to ascertain them; but they are so near, and agree so well with our observations on stairs of easy ascent, that they may be taken for the elements of a practical rule. Hence, according as h or p is given, we have $h = \frac{1}{2}$ $(24 - p$, or $p = 24 - 2h)$. Thus, if the height of a step be six inches, then $24 - 12 = 12$, the width or tread for a step that rises six inches."—*Encyclo. Britannica.*

As to the width of staircases, this, of course, depends on their destined or probable use, and the number of persons which it may be desirable to provide accommodation for the passage of at the same time. Four feet in the clear is the least width that should be allowed for two persons to pass each other without inconvenience; and two feet six inches is the least width that should be permitted for one person. The circumstance of the ballusters being fixed outside to the vertical ends of the step—a practice originated in France—or on their horizontal surface, necessarily affects the width to be set out. The height of the balustrade may be from two feet four inches to three feet; and it may be formed of wood, iron, or stone. The various ingenious methods of finding the lines for the handrails of the wood and iron ones, belong to the joiners's department.

Plate 39*a*, illustrates two useful arrangements of the staircase, united to a certain amount of architectural decoration. In the upper design, greater importance is given to the entrance to



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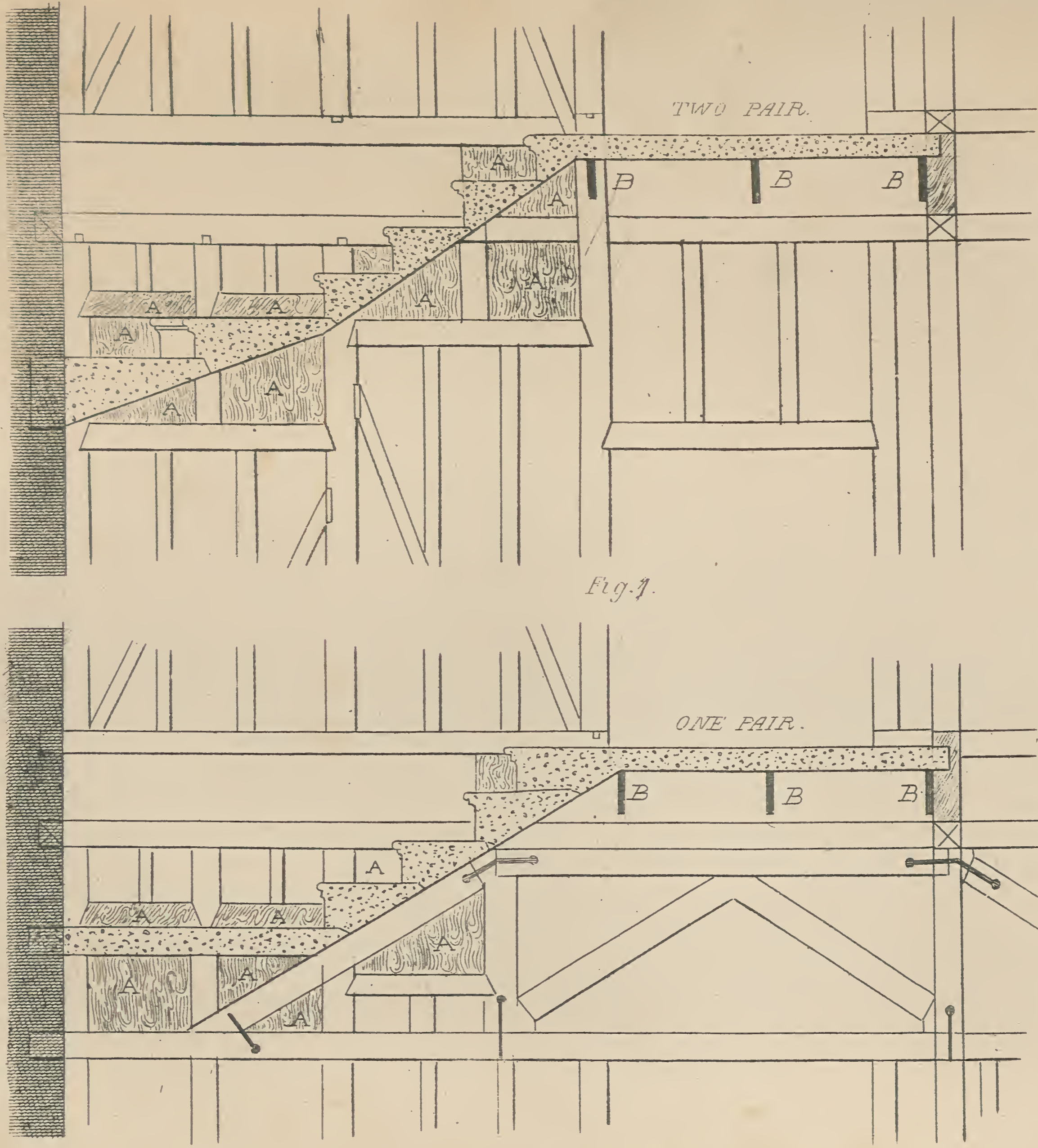


Fig. 1.

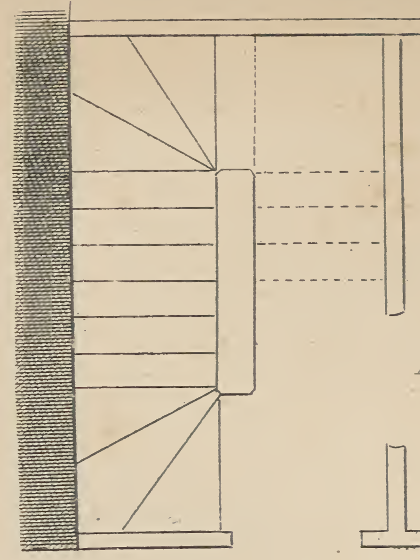


Fig. 3.

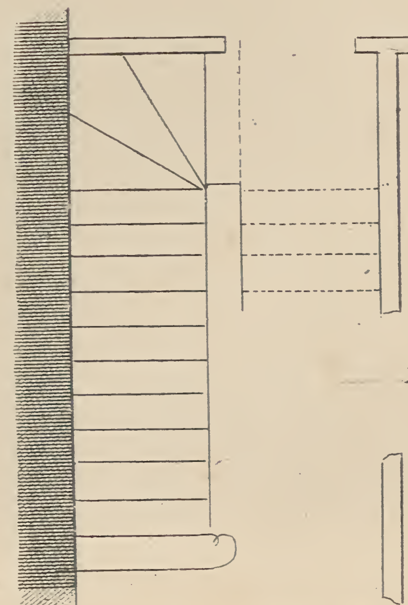


Fig. 2.

SCALE TO Fig. 1. 0 1 2 3

SCALE TO Fig. 2 & 3 0 1 2 3 4 5

the staircase by lengthening the lower steps, the expense being but slightly increased; while the screen enhances the general effect, and the position of the entrance is centred with respect to the side of the room, or lobby, from which it is reached. The lanthorn also forms a conspicuous and useful feature.

In the lower design the principal staircase is combined with a large hall lighted at the sides, subsidiary staircases leading to it from lower levels, or below. Both these designs shew the close string, in the first joined to a solid newel, and they have each a panelled parapet which might be enriched by perforation or ornament either in stone or metal.

In the foregoing observations, we have been offering remark principally with reference to the construction of staircases as connected with stone and other walls of a similar kind. Sometimes, however, such are required to be erected against less substantial and assisting portions of a building, as, for instance, against what are called quarter partitions, and such-like formed divisions of an edifice. It is most to be desired, certainly, that the stone stair should be built, and as the least open objection, derive its support from main or other walls; but this is not always in modern house-building to be done, particularly where great altitude in the same is required. In these cases, the ends of the steps frequently have to be secured to, and receive their support from, a partition such as we have mentioned. To secure a proper rest, and the requisite resistance to the downward tendency of the projecting step, under the circumstances usually of much less substance and solidity to deal with, as well as of considerably less weight above than in the case of a solid wall, is the point here to be attained. To attempt this in ordinary quarter partitions with any assurance of safety would be useless. A partition of this kind, intended to receive a stone stair, should never be less than six inches thick in its rough timbering, and the stone steps, which it is intended it shall support, should tail in to equal extent, the more so as it will frequently and unavoidably happen that some of the stones will have to be cut away or chased out in parts, to allow of non-interference with the main posts or other upright timbers of the partition; for it will not always, indeed rarely, fall out that the latter will be so placed or work as to allow the former to pass into the thickness of the partition between them, so that, as the timber framing must be preserved intact, the stone must be subservient where the two come together and are opposed in this way.

In *Plate 39b*, we give an illustration of the manner in which a stone staircase may be constructed in connexion with a quarter partition. It will be seen on reference to *Figs. 2* and *3*, which represent plans of the staircase at the levels of the one and two pair, or rather leading from the ground to the one pair, and from the one-pair to the two-pair stories respectively, that it is enclosed on three of its sides by partitions, having a wall only on its fourth.

On *Fig. 2*, the lower flight of flyers and two of the three winders on the quarter pace are supported from the wall, the remaining four flyers, with a second quarter pace and the landing above, being supported in the partition.

Fig. 3, is similarly arranged in all the main points. The partition opposite the wall in *Fig. 2*, is a trussed partition, and, as will be seen on reference to the lower section, the upper or one-pair landing is run under the cill of the one-pair partition, which stands immediately over the head of that below, the depth of the floor joists only being between. It is also run under that of the return partition to the wall, and further assisted by iron brackets B, B, B,

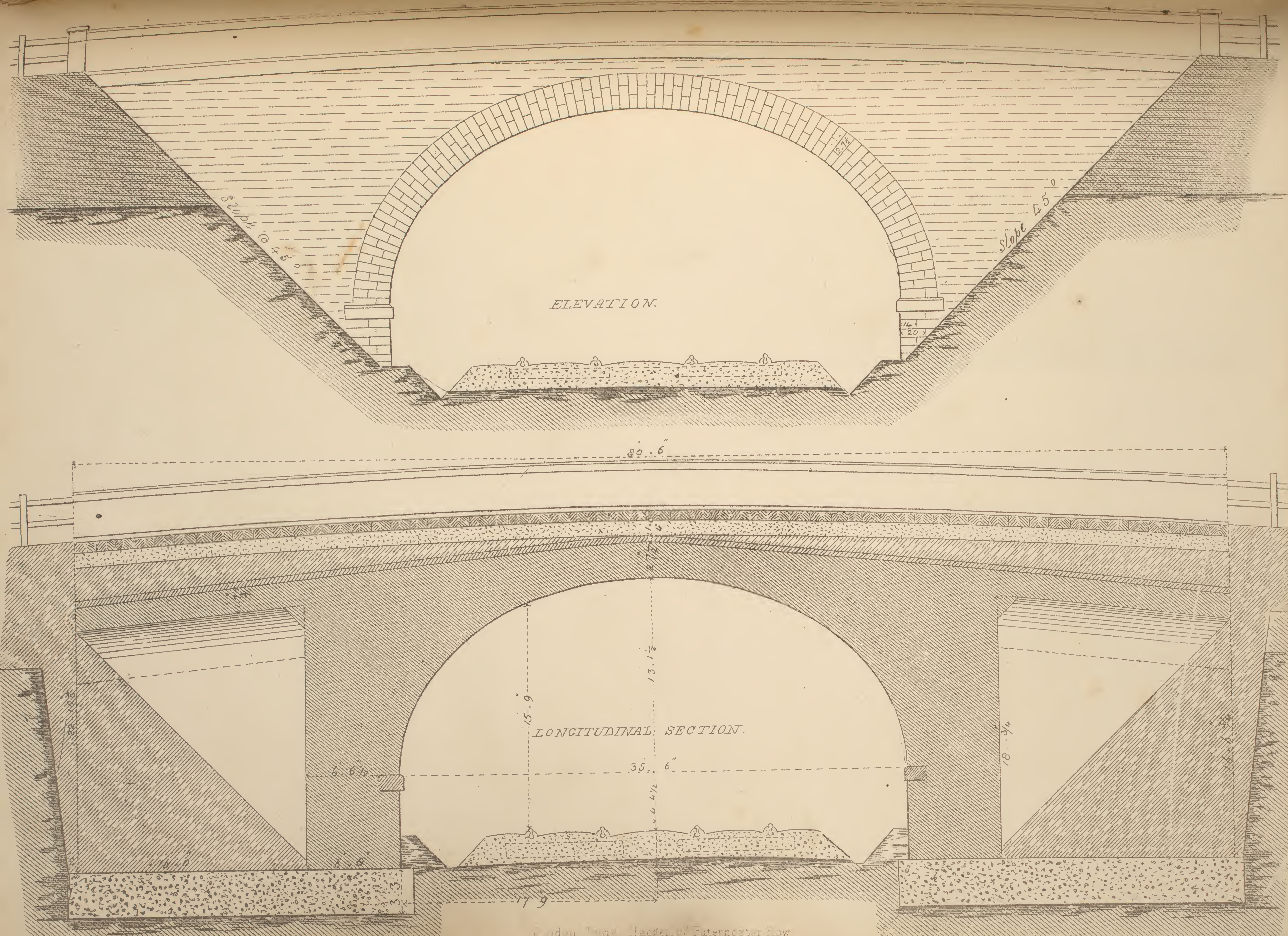
secured to a floor trimmer beneath it. The several steps should be also so placed as to run under the main horizontal timbers of the partitions, wherever possible. Where this is not practicable, as will unavoidably sometimes take place, the steps must be notched to pass the obstructing upright and other timbering, and be made to rest upon oak templates inserted in the partition, their upper surfaces being secured by similar oak templates for leverage. These templates are indicated on the sections by the letters A, A, A, &c., and care should be taken, in preparing and fixing them, that the grain of the wood is placed vertically as affording greater solidity and resistance.

The illustration given in the Plate is from an executed example, and has been found to answer very well.

CHAPTER XVIII.

RAILWAY BRIDGES AND VIADUCTS.

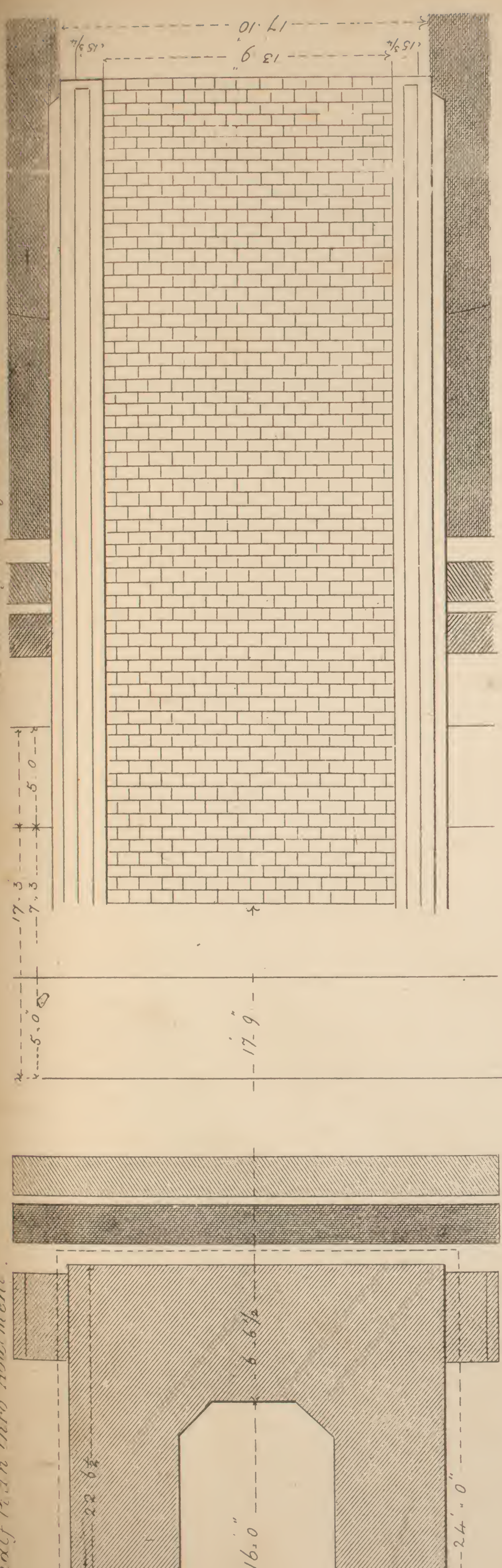
The bridge which we give in *Plate* 40, as the first of our illustrations of railway works of similar description, proposes to be one thrown, for the preservation of an occupation road, over a railway, and as distinguished from that in *Plate* 41, to which we shall presently refer, is supposed to cross such railway at right angles to the course of the latter. It may be constructed either of brick or stone, stone being presumed in the Plates, or composed of both, in either case according as local circumstances and convenience may dictate. If of stone, the directions in relation to the construction, given in the description or rather specification for the viaduct shewn in *Plates* 41^c, 41^d, and 41^e, should be adhered to, as in most particulars applicable. If of brick, it is essential to good work that the bricks should be throughout hard and sound, well shaped and thoroughly burnt, of uniform size, and also in the outside work, for the sake of appearance, of uniform colour. Each brick should be well saturated in water previously to being set, and none but whole bricks should be used except for closers, or, in moderate proportion, for backing in. In other respects, and generally, the brickwork should be executed in the manner usually stipulated for as the best and most workmanlike, with the proper amount of joint and the requisite flushing up, &c., at every course. The bond to be preferred is the old English bond. If the plinth and coping of the parapet wall be executed also in brick, this part of the work should be in cement. If they are constructed in stone, the plinth should be of *picked*-dressed ashlar, and the coping of *chisel*-dressed ashlar. The string course at the springing of the arch must in either case be of stone, and of picked-dressed ashlar. In the case of a stone construction entirely, great care must be taken that the voussoirs of the arch are worked truly and with due regard to the different radii of the elipse, and an accurate and level bed is a point which should be observed in all cases. If plugging and dowelling be introduced, as may sometimes be necessary, from extended space or other causes, some of the methods described in the Chapter on Cramping and Dowelling may be referred to. In ordinary


ELEVATION.
Slope @ 45°
Slope 45°
2.7½
14
20
80 . 6"
LONGITUDINAL SECTION.
35 . 6"
15 . 9"
13 . 1½
18 . 3/4
6 . 6½
3 . 3
17 . 9

OCCUPATION ROAD BRIDGE.

General half Plan finished

Sectional half Plan thro' Abutment



Transverse Section Through The Centre of Bridge

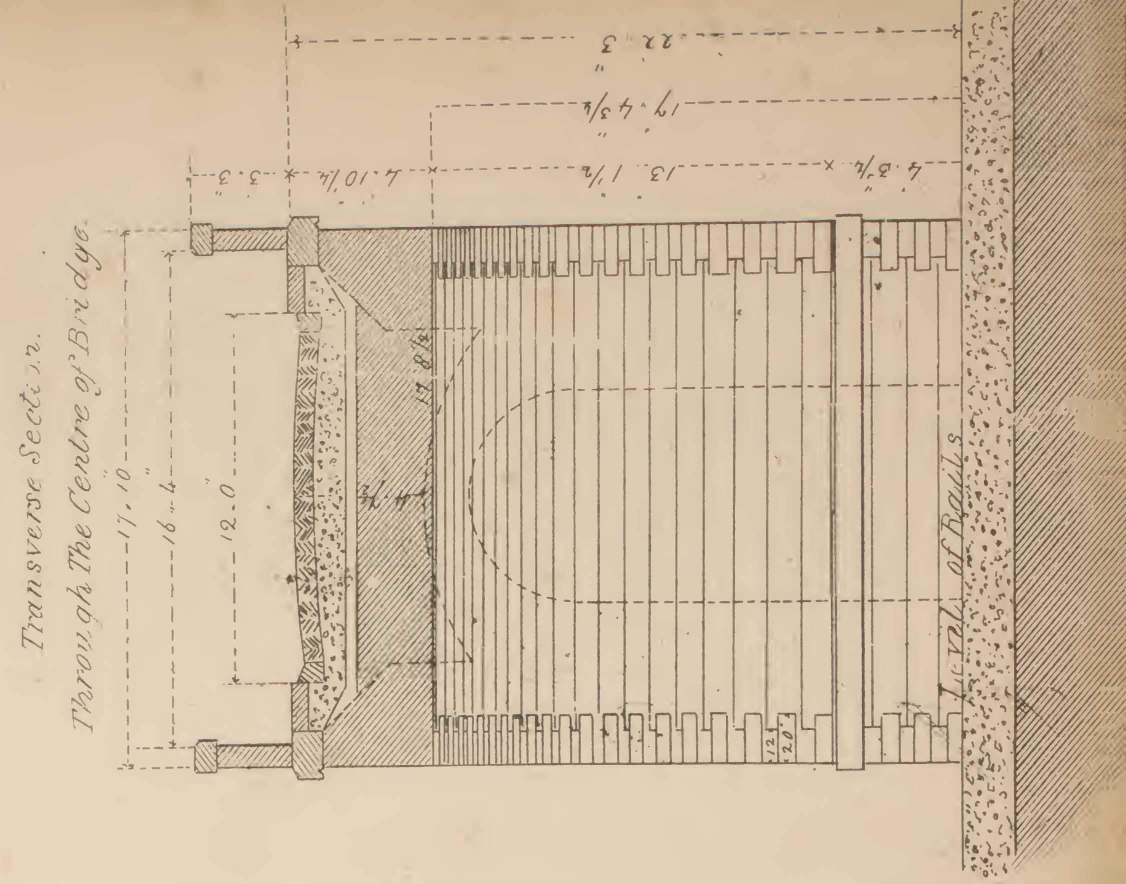
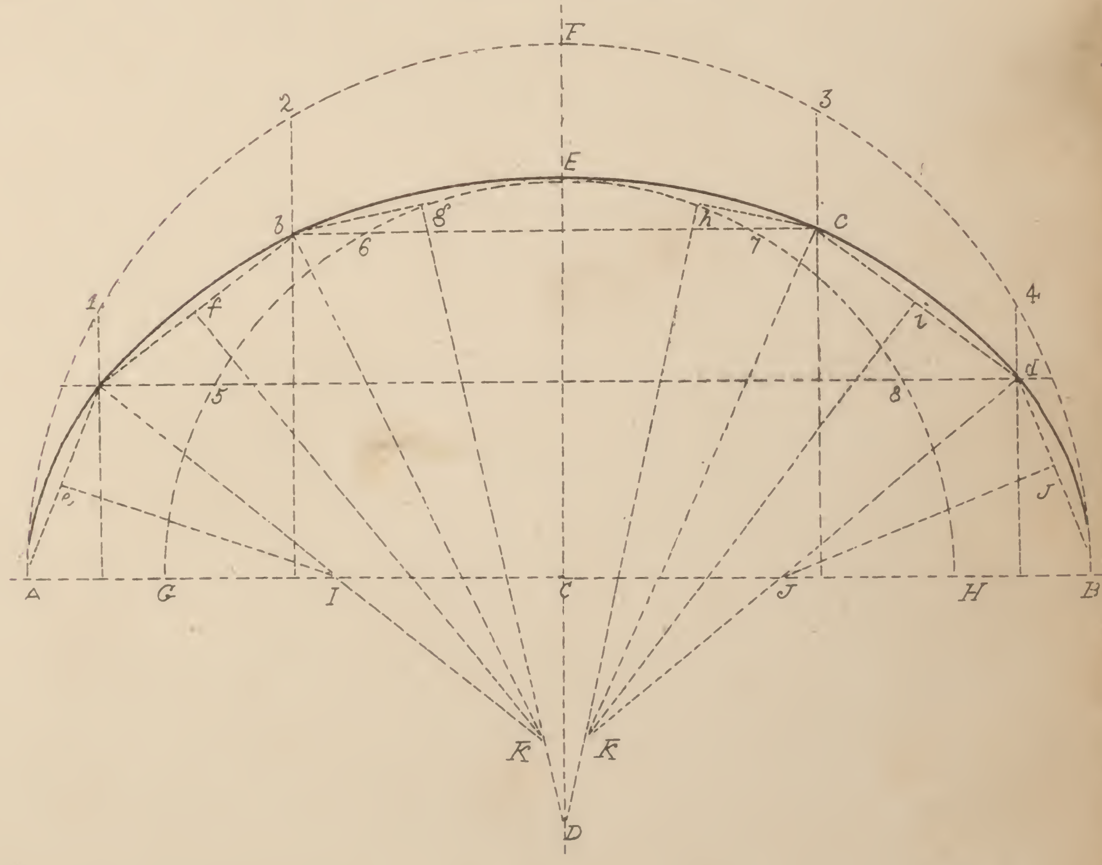
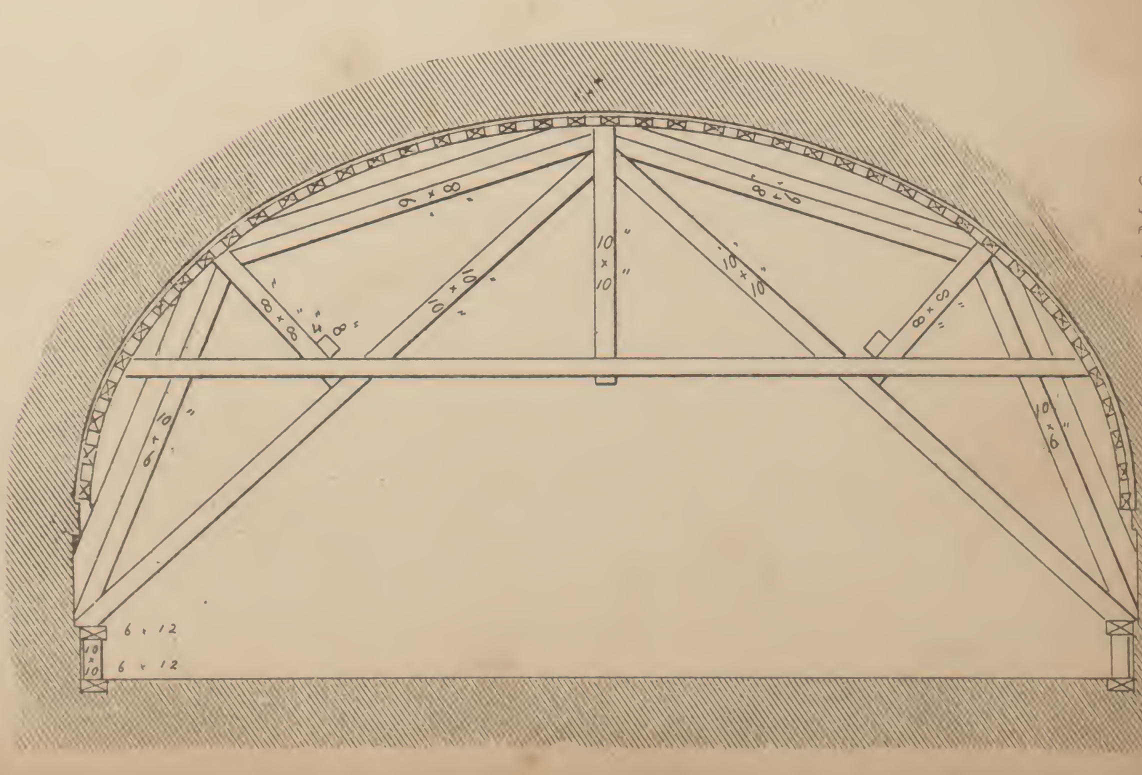


Diagram Showing the Developement of an Elliptical Curve. from 5 Centres



Elevation of Centering for Arch.



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bridges of the kind we are noticing, under proper care in construction, these will hardly be necessary.

It is to be observed, that if the road over the bridge be deviated or raised, such, as well as any other approaches to the latter, must be carried back sufficiently for the proper rate of inclination, which is, in most cases, regulated by Act of Parliament; and it should have, at least, six feet greater width than the bridge itself in the clear—that is to say, between the parapets. These latter matters are, however, merely to be noticed as incidentally connected with the operations of the mason in the bridge-building here described, but which usually form parts or features of the drawings from which he works, and which, consequently, are necessary, in a measure, to be understood by him, with a view to the regulation of many parts of his performance.

On referring to *Plate* 40, it will be seen that the upper figure represents a geometrical elevation of the bridge, in connexion with a sectional cut through the permanent way of the rail, with its enclosing cutting and the raised embankment of the roadway at the sides of the bridge-approach. The lower figure is a longitudinal section through the centre of the bridge and its abutments, &c., shewing the formation of the roadway over it, and the various other details of its construction.

Plate 40*a* shews other portions of the detail—the two upper being respectively a sectional half plan, through one of the abutments, and a general half plan of the bridge, as finished, and looking down thereon. The three lower figures shew—

First, a transverse section through the centre of the bridge;

Secondly, an elevation of the timber centering for the arch; and

Thirdly, the development of the elliptical curve of the same.

The three first figures—viz., the plans and the transverse section—will sufficiently explain themselves; and of the fourth it will be unnecessary to say more than that the centering there shewn will be found very simple and efficient. In relation to the fifth, or last, it will be requisite to add the proper demonstration of it.

To describe the semi-ellipse from five centres, as here shewn, in which A B is the span and C E the rise, first, from the centre C, with the radius A C, describe the semi-circle A, F, B, which divide into six parts, as 1, 2, F; 3, 4, B; then, with the radius C E, describe from the centre C, the semi-circle G, E, H, which also divide into six equal parts, as 5, 6, E; 7, 8, H. Next, through 1, 2, 3, 4, draw lines parallel to F C; and through 5, 6, 7, 8, draw two lines parallel to A B. Then, with straight lines through the points of intersection, a, b, c, d, draw a A, a b, b E, E c, c d, and D b; bisect each of these lines respectively, as at e, f, g, h, i, j; and at g and h let fall perpendiculars, intersecting F C, produced to D, when D will be the centre of the segment b, E, c. At f and i let fall in like manner perpendiculars to a b and c d, respectively intersecting g D and h D, at K K, when K K will be the centres of the segments a b and c d. At e and j, also let fall perpendiculars to A a and d B, intersecting respectively a K and d K, at I and J, when I J will be the centres for the segments A a and d B, which form respectively the remaining portions of the curve of the ellipse.

From the above it will be readily understood that the greater the numbe-

made in the semicircle, the more numerous will be the centres, and the nearer the approach of the curve to the true ellipse.

Plates 41, 41[a], and 41[b], illustrate a second description of railway-bridge, differing from the last described, from being what is technically called a skew-bridge—that is to say, one constructed to cross an occupation or other road, at other than a right angle. There is also the difference that in this case the bridge carries the rail over the occupation-road, while in the other the bridge carried the road over the railway. These skew bridges are frequently met with, and afford some of the best instances of the constructive skill of the mason or bricklayer. The general principles employed in their erection, and the practices to be followed in the execution of the work, are similar to those advocated and directed in the last instance. It will be needless, therefore, to recapitulate on this score; but it must be borne in mind that extreme care is required in the proper development of the voussoirs or arch-stones, in these cases, which, from their cross direction, require great nicety of adjustment and peculiar regard to radiation. On these and the other points of formation to be observed in parallel cases to that which they represent, it is believed the plates will give all the requisite information; we may, therefore, at once, and without further observation, direct attention to them.

Plate 41 shews, as will be seen in *Fig.* 1, an elevation of a skew bridge taken in the direction of the line A A on the plan of the same given as *Fig.* 2, on the same plate; the one side exhibiting the counterfort in section, and on the other in foreshortened elevation.

Fig. 2, is a plan of the bridge and its counterforts, shewing the direction of the occupation-road beneath, and the angle formed by the course of the railway above.

Fig. 3, is a plan of the intrados or soffit of the arch, shewing the coursing of the voussoirs.

It may be observed, that the material employed in the construction may be here, as in the first-described bridge, either wholly of stone or brick, or of a mixture of the two. In the plates, the arch-stones of the faces and of the piers and angles, with the coverings or copings of the counterforts, and the strings, are shewn of wrought stone. The other portions may be taken to be brick or coursed stone, pick-faced or otherwise. The parapet is in this case shewn as of cast iron, and if so, should be composed of plates 4 feet long by 2 feet 11 inches high, with a coping also of cast iron in about 8 feet lengths, so arranged that the two shall break-joint with each other, the latter being secured to the former by means of countersunk tap-screws. The piers at the ends of the parapets are of stone.

Plate 41[a] gives in the upper figure a longitudinal section of the bridge taken on the lines B, B, B, B, on the plan given in *Plate* 41; and in the lower figure an elevation of the same viewed on the square. The former shews the centering for the arches, the concrete foundations and other details of the interior construction, with a section of the embankment and the culverts on each side, the permanent way for the rails being also indicated.

Plate 41[b], exhibits further details of the same bridge, viz., a transverse section through the centre of the main arch; the detailed elevation of the foot of the wing wall; the detail of the string course at the springing of the arches; an enlarged plan of the counterfort, with a general

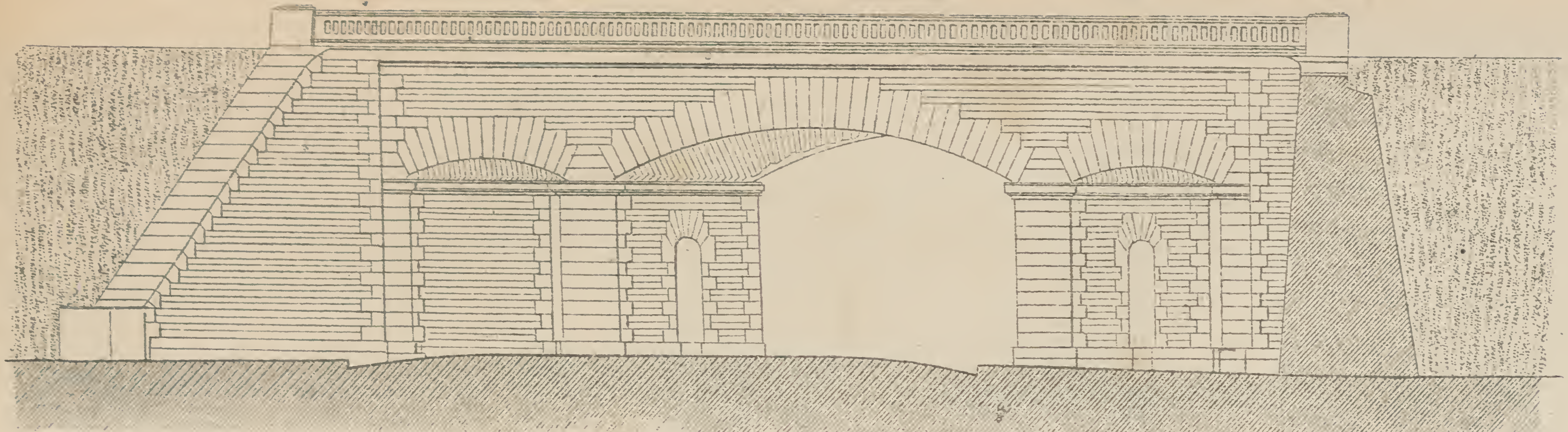


Fig 1. ELEVATION ON THE LINE AA.

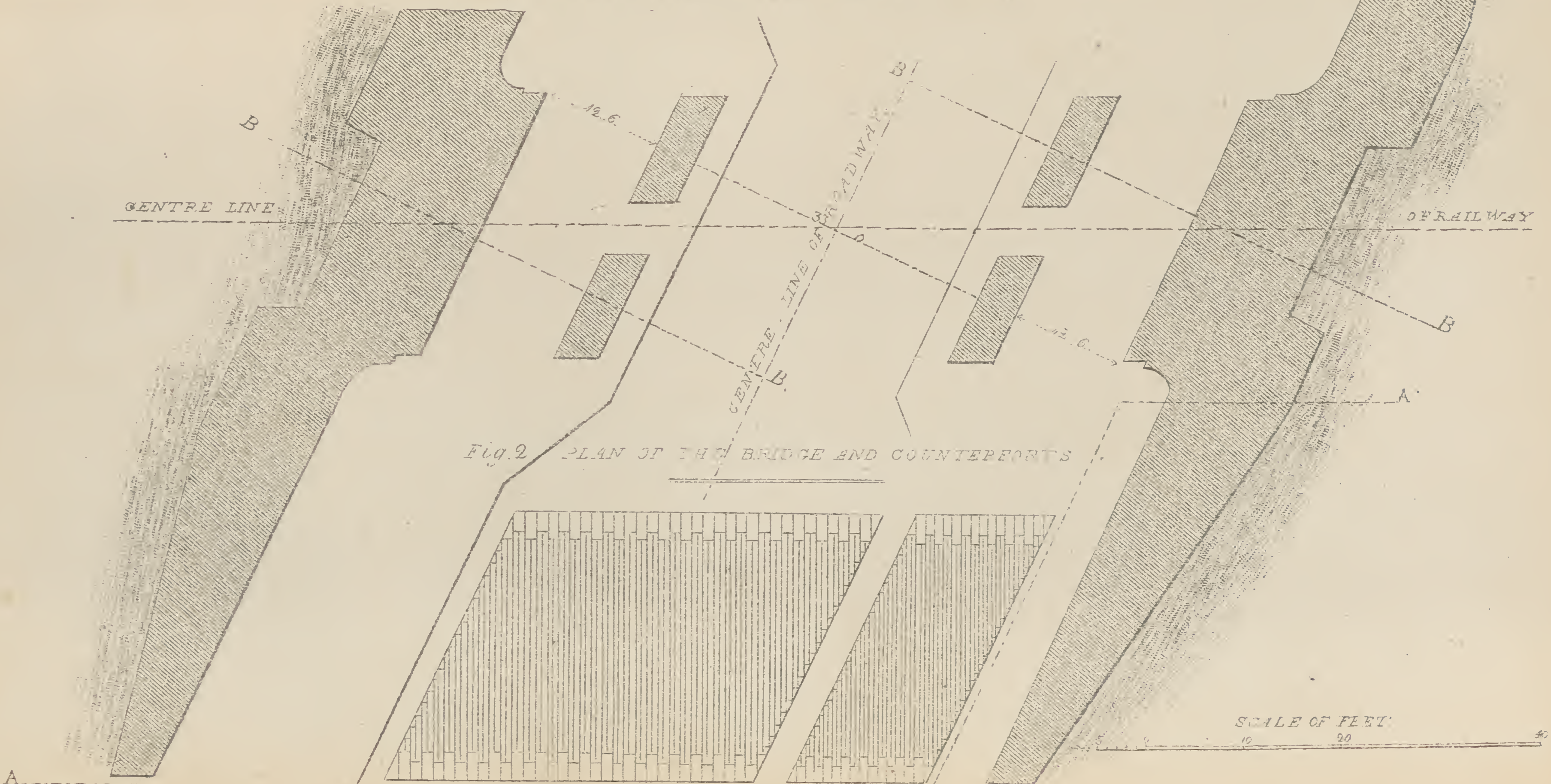
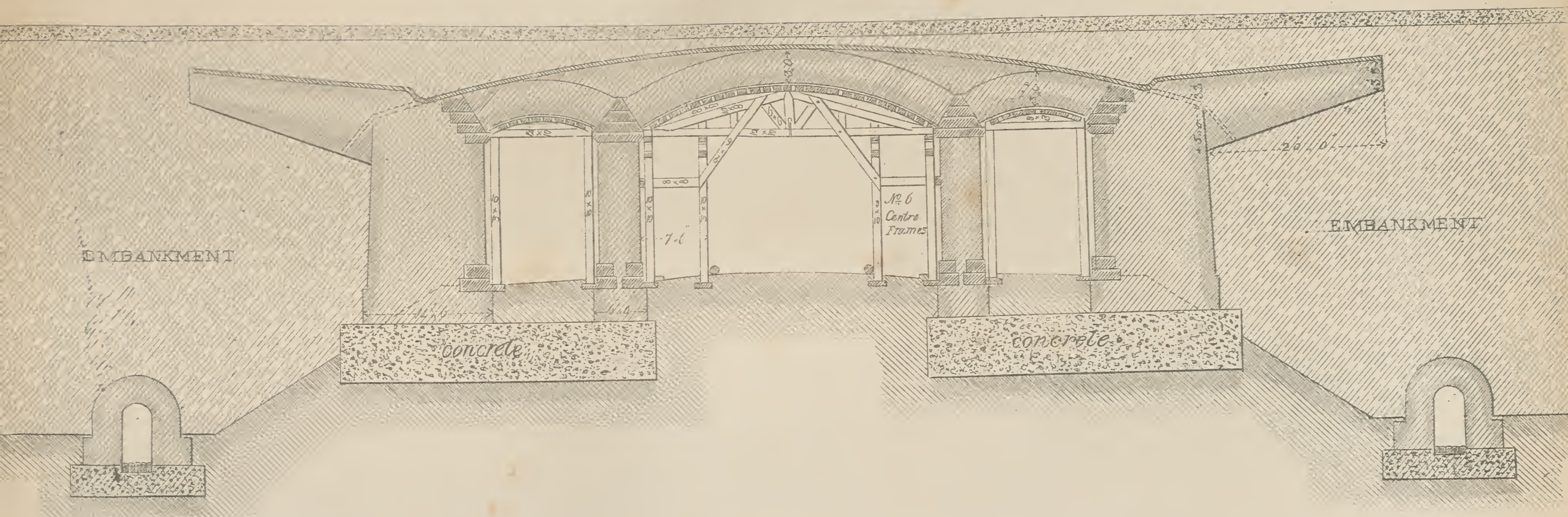


Fig. 2 PLAN OF THE BRIDGE AND COUNTERFORTS

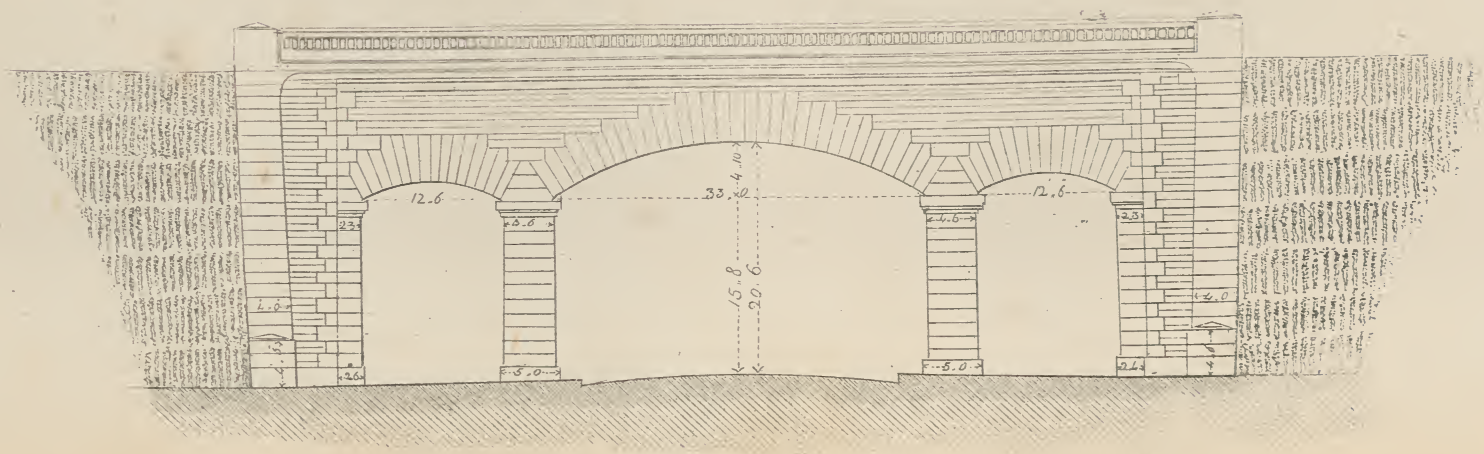
Fig 3 PLAN OF THE VOUSSOIRS OR SOFFIT

SKEW BRIDGE OVER OCCUPATION ROAD.

Longitudinal Section. BBBB.

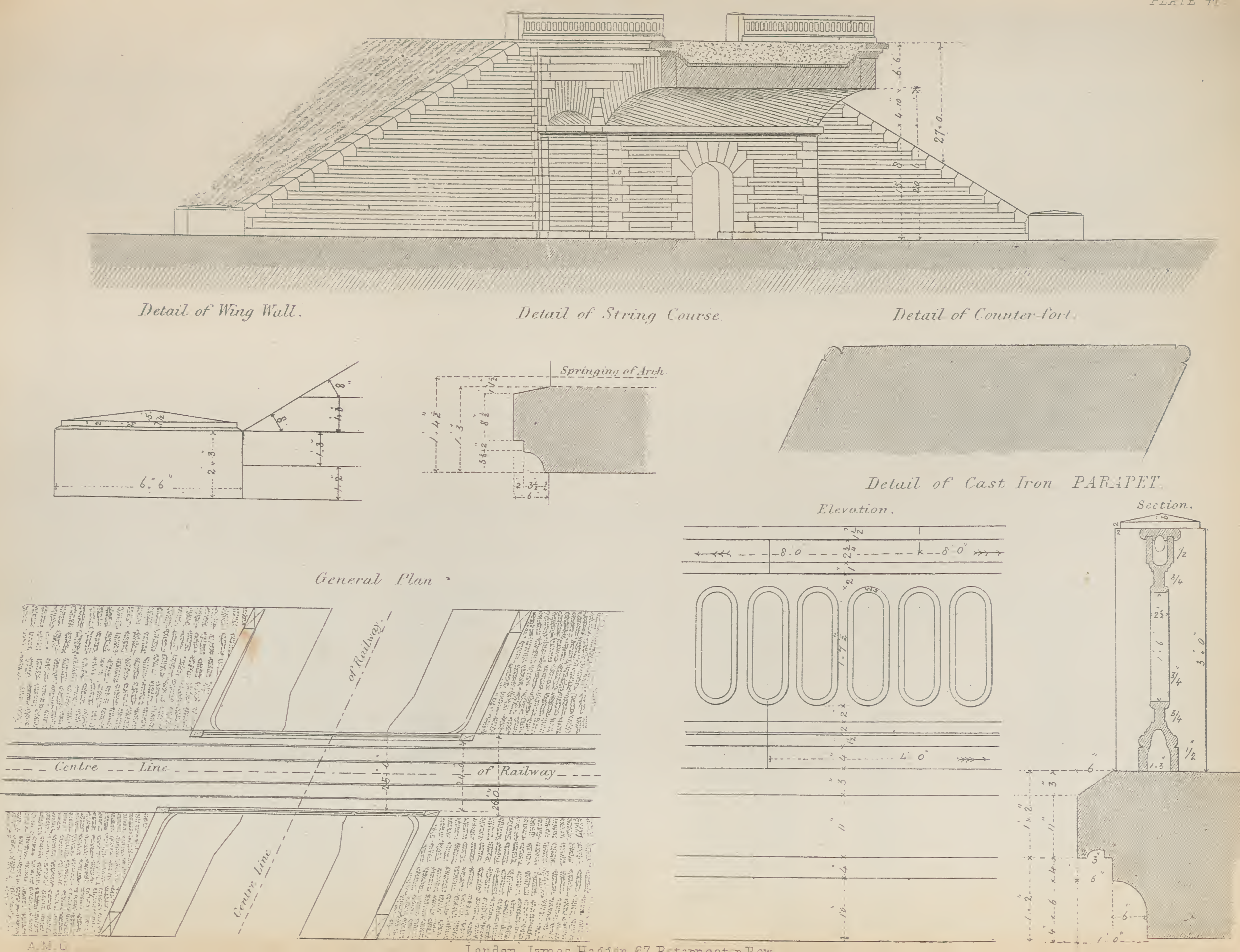


Elevation on the Square



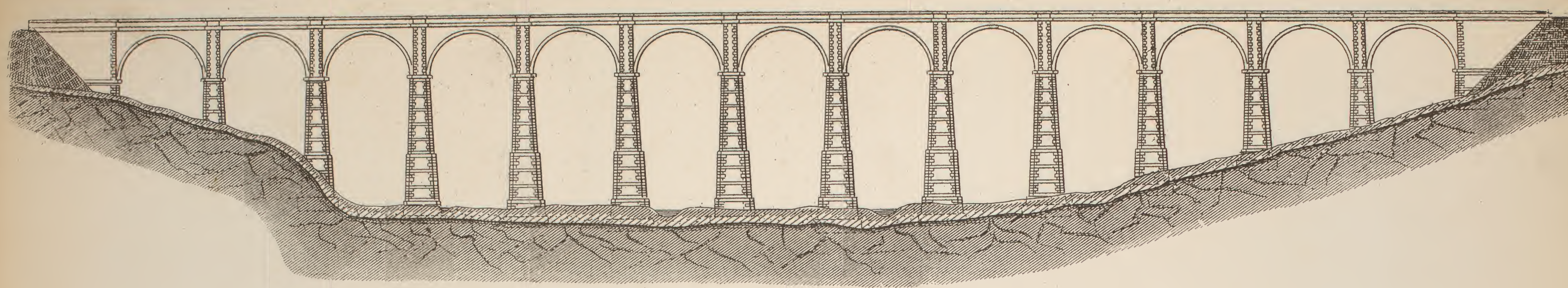
A.M.G.

London: James Hagger ...

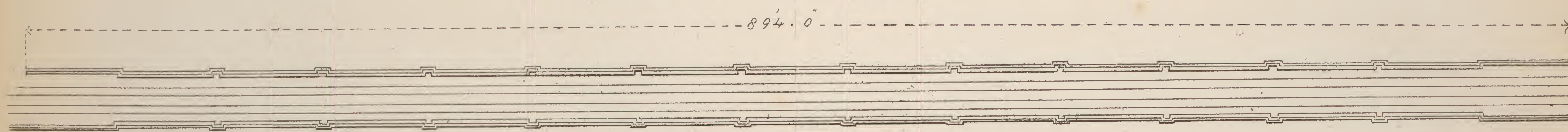

Detail of Wing Wall.
Detail of String Course.
Detail of Counter-fort.
Springing of Arch.
Detail of Cast Iron PARAPET.
Elevation.
Section.
General Plan.
Centre Line of Railway
Centre Line of Railway
A.M.C.

DETAILS OF VIADUCT OF 13 ARCHES.

General Elevation.

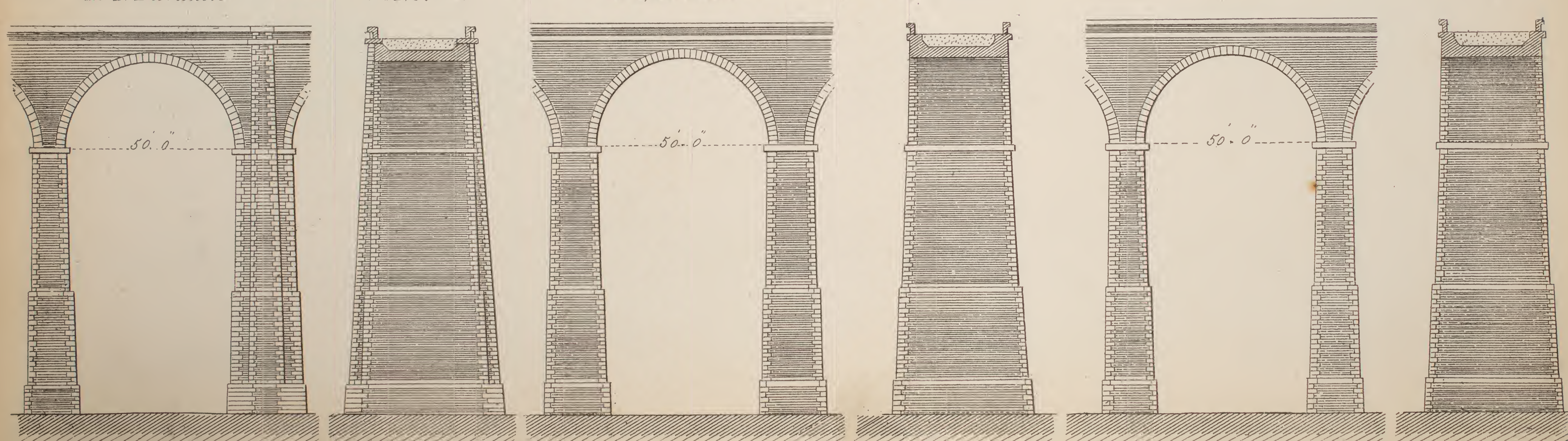


General Plan of Parapet and Railway.



THREE DESIGNS ADAPTED TO THE ABOVE.

N.º 1. Elevation. *N.º 1. Section.* *N.º 2, Elevation.* *N.º 2, Section.* *N.º 3, Elevation.* *N.º 3, Section.*



A. M. Q.

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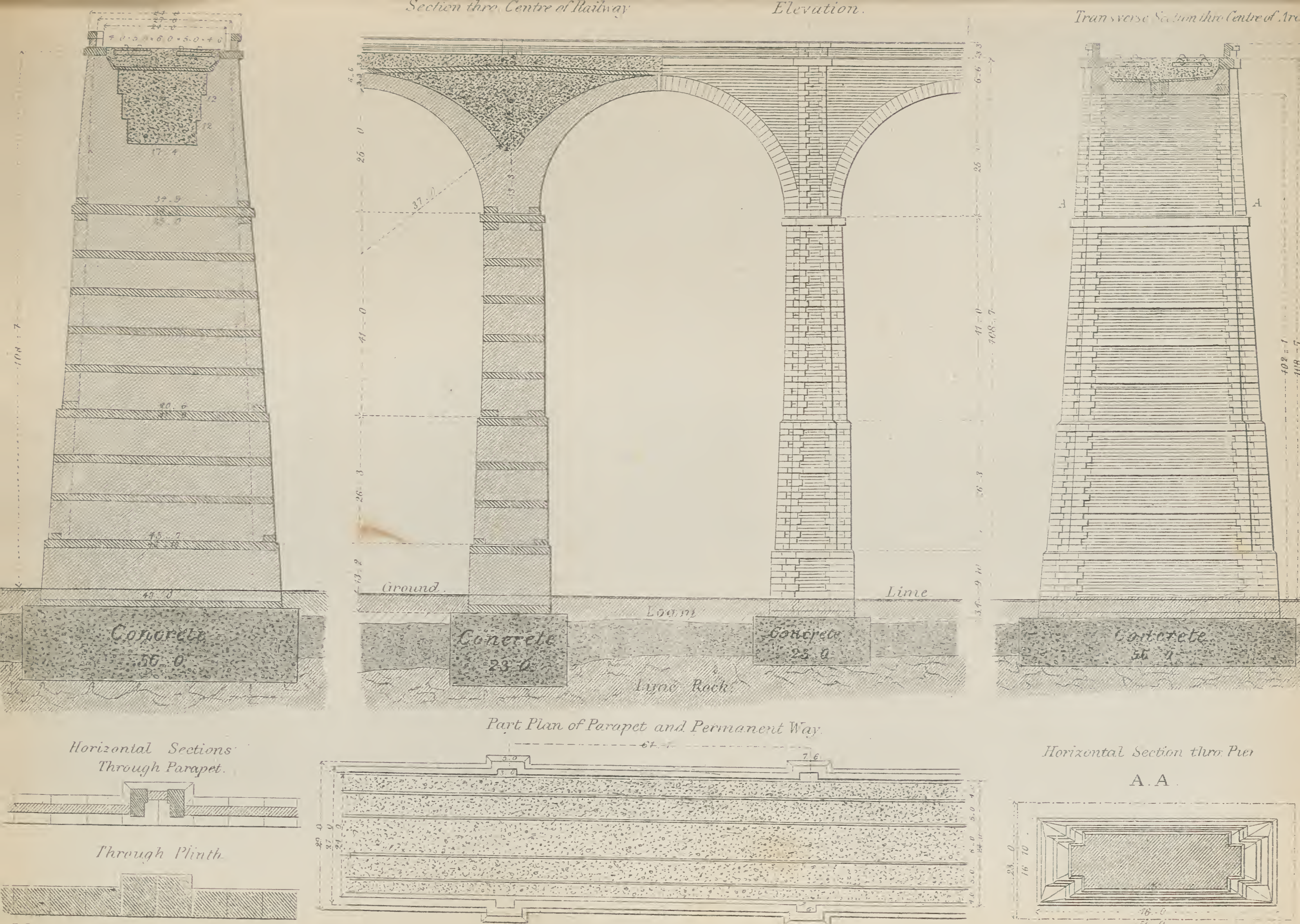

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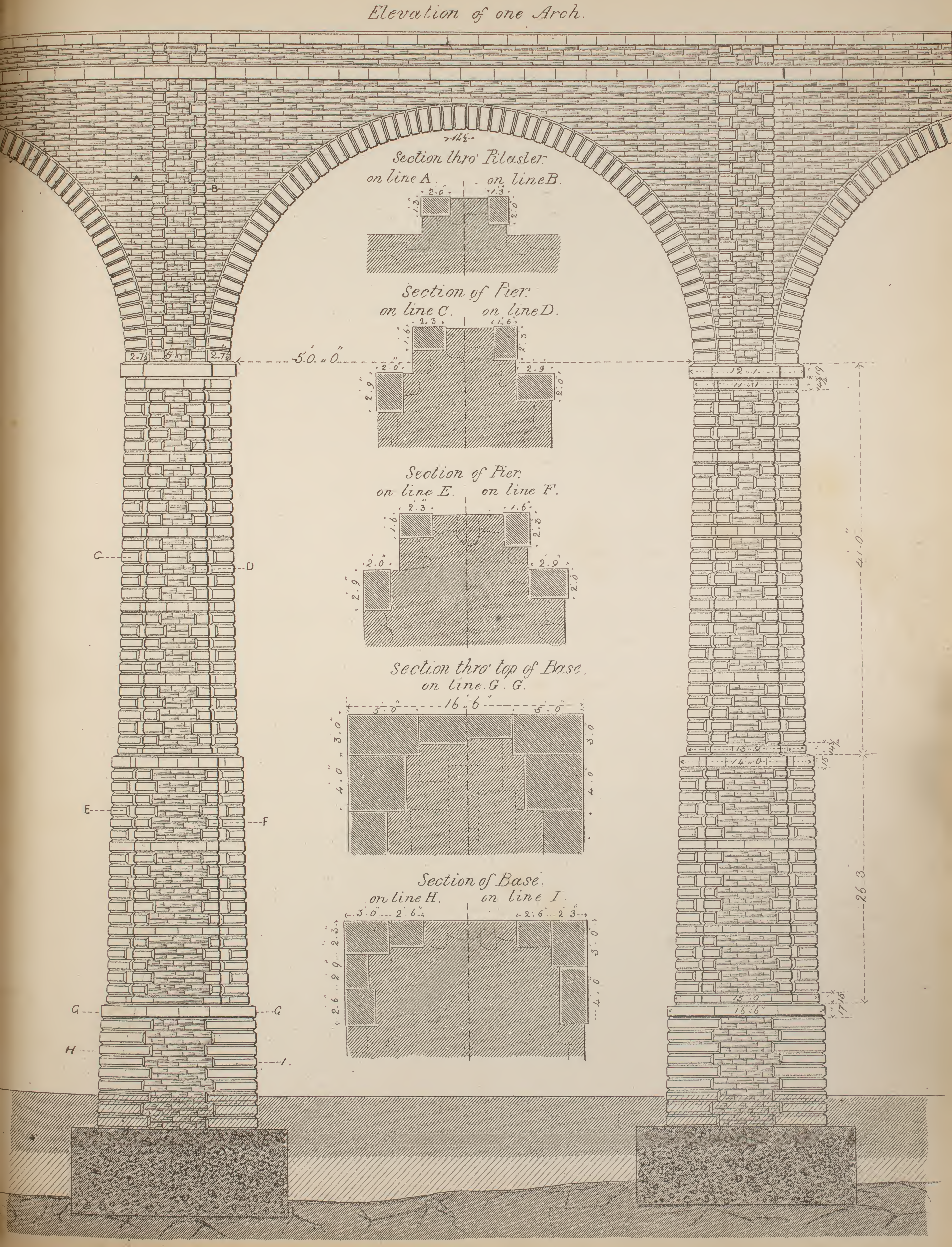
DETAILS OF VIADUCT OF 13 ARCHES.



plan of the bridge and railway in connexion therewith, and the detail or enlarged elevation and section of the cast-iron parapet.

Having thus far referred to the ordinary kinds of railway bridge in connexion with roadways, we will proceed to illustrate briefly similar work as applied to viaducts; in doing which, as the readiest means perhaps of conveying the requisite information with relation to the best modes of designing and executing such work, we will embody the heads of a specification thereof, from a comparison of which with the drawings given, and a connected examination of and reference to the two, a clearer and more ready understanding of the whole matter may be obtained.

The viaduct shewn in the *Plates* 41c, 41d, and 41e, consists of thirteen arches of fifty feet span each, making with piers and abutments a total length of eight hundred and ninety-four feet. Its greatest height is about 109 feet, and we have presumed it to cross an ideal section of ground intersected by three water courses, as shewn in the upper figure of the first-mentioned plate, which exhibits its full elevation; the second figure shewing its plan looking down on the permanent way and rails. It will be seen that each pier is strengthened by buttresses upon the face, as is more clearly shewn in the enlarged elevation of the same given in *Plate* 41d. These buttresses may, however, in many cases be dispensed with, and the piers constructed after the fashion shewn in Nos. 2 and 3 of the three designs given on the lower part of the Plate, as variations of the first, or they may be introduced more sparingly, as in No. 1 of the latter, either at every alternate pier or at still further distances apart.

While, on the three variations in the design here shewn, it may be observed that No. 3 would be the cheapest, No. 2 the next, and No. 1 the more costly of the three, as would naturally be looked for from the increased substantiality of the piers in each case. The adoption of the one or the other must necessarily depend on particular situation and circumstance.

Plate 41d shews the construction of the viaduct according to the upper design to an enlarged scale, the first or left-hand upper figure being a transverse section through the centre of the pier, shewing the bonding or perpend courses, and the concrete foundation and filling in at the haunches.

The third or right-hand corresponding figure is a similar transverse section taken through the centre of the arch.

The second or centre figure shews on one-half an elevation of the pier and arch of the viaduct, and on the other half a longitudinal section through the same, representing the exterior appearance, and the interior construction of the same respectively.

The three lower figures shew horizontal sections through the parapet and plinth, and the body of the pier, taken at A, A, on the third figure, and a portion of the plan of the viaduct looking down on the parapet and permanent way. In the three larger figures the presumed substratum is indicated as lime rock, upon which the concrete foundations, &c., are shewn as laid.

Plate 41e is simply an enlarged elevation of one part of the viaduct, with horizontal sections taken at various points through the piers, shewing more clearly the quoining and facing, and other detail of the work.

Having thus completed what may be considered a necessary description, in elucidation of the plates, we will subjoin the general specification, before referred to. It is to be noted that this is prepared principally with reference to the works of the viaduct; but it is, nevertheless, in all material, as well as in many of the other particulars, applicable to the case of the bridges—the work to be executed being, in fact, of the same class, and in many points identical as respects the nature of it. To commence then with

The Excavations.—These should be of the requisite size for the reception of the concrete, and should be carried down, as shewn upon the sections, through the loam, coarse gravel, &c., to the limestone rock, which has been assumed, in the case of the viaduct, to be the substrata; and the latter should be levelled and stepped, according to the requirements of the case; any disintegrated portions of the rock, occurring on the site of the foundations, being picked level to such depth as may be necessary to remove the same and reach a solid surface. In the case of less substantial groundwork for the foundations, the excavation should, in all instances, be carried down to what is technically called the bull-head, or undisturbed formation, and the concreting commenced immediately upon this. This latter is the substratum presumed in the case of the bridge shewn in the drawings.

The Concrete.—This should be composed of good hydraulic lime, in the proportion of one part of lime to six parts of gravel, and one part of sharp, clean *river*-sand. To be put in, in layers of not more than four inches thick at a time; each layer to be well spread in before the next is laid on.

The Mortar should consist of local or other approved lime, and clean, sharp river-sand, or road drift, in the proportion of one measure of unslaked lime to two measures of the sand. This should be well mixed in a dry state, and tempered with a proper proportion of water.

The *Cement* used should be Portland, or the best Roman cement.

The Masonry.—The general masonry, both of the viaduct and the bridges, is presumed, in the drawings, to be good sound rubble of the stone of the country, hammer-squared and neatly coursed—each stone, more particularly in the former case, to contain not less than one-sixth of a cubic foot; the same to be laid so as to make the closest possible work, well bonded; each stone to be well bedded in the mortar when laid, and the upper surface of the work, including the backing, brought to an uniform level at the height of every course of the facework, and the whole fronted. The quoins of the abutments and piers, together with the arch-rings, may be pitched blocking or rock-ashlar, bonded as shewn on drawings, having a chisel-dressed chamfer round each outside edge; each stone to be carefully dressed on the beds and joints, those of the arch-rings to be accurately gauged to the radii of the arches. The piers to have bands of blocking-courses throughout their thickness, as shewn in sections. The masonry in the base of the piers, which may be subjected to the action of water, to be lipped in cement, for not less than three inches from the face. The string-course at the springing of the arches, the plinth and the coping of parapet walls, should be picked dressed ashlar; the lengths of the latter to be connected by four-inch hard stone dowels, set in cement. The method of throating the coping is shewn

in the section through the parapet of the skew bridge, given in *Plate* 41*b*. The parapet walls should be in four courses, uniformly bedded and jointed; and with the other exterior work of the piers, abutments, and spandrel walls, should have the coursing and vertical joints fairly struck, raked out, and lime-pointed as the work proceeds. The spandrels should be filled in with backing to the height shewn in the plates, laid to fall from each side of the pier to the crown of the arch; and a layer of puddle, six inches thick, the whole width of the viaduct, should be carefully laid, so as to have a fall from every direction to the inlet to the iron gutter, shewn in the section through the viaduct, given in *Plate* 41*d*, as fixed in the centre of each arch, for the purpose of draining the roadway. The latter to be ballasted in the usual way, to the height required, with broken stone and coarse gravel.

The Centering.—The centering, which it will be necessary to provide for the construction of the arches, falls within the province of the carpenter. It will only be necessary, therefore, here to refer to the delineation of it in the plates, where it is shewn with its necessary detail and dimension, and to say that it should be formed of good, sound, clean timber, and that great care should be taken it is not struck or removed too early—that is to say, before the work which is constructed upon it has thoroughly settled and obtained the proper adhesion and bearing of one part with another. The absence of the requisite attention to this point has occasioned failure in several instances. It is better to incur the expense of additional sets of centres, than to risk the improper settlement or destruction of the new work by hasty removal of a limited quantity for the purposcs of reuse.

CHAPTER XIX.

ON CHIMNEY-PIECES.

THE Chimney-piece, in modern architecture, is a feature of very considerable importance; receiving, in a number of cases, a large amount of architectural consideration and treatment. Indeed, a good and handsome chimney-piece is, in the present day, a *sine quâ non* in all superior rooms. Ware says, "With us no article in a well-furnished room is so essential. The eye is immediately cast upon it in entering, and the place of sitting down is naturally near it; and by this means," he continues, "it becomes the most eminent thing in the finishing of an apartment."* These are the sentiments of a period not very far removed from our day; and they have remained, in hardly less degree, those of the present time.

* "Complete Body of Architecture." Folio. London: 1756.

The more common forms in which the chimney-piece appears in modern practice is that of various arrangements of classic features and detail; Gothic and Elizabethan are also occasionally introduced. The latter are to be classed as the retentions of the forms in which chimney-pieces made their first appearance, as distinguished from the mode of treatment usually adopted in the finish of the earlier fire-places of this country. The chimney-piece of the Elizabethan time was often of the most imposing and elaborate description; in some instances—following a practice also exhibited in some of the later mediæval foreign chimney-pieces—reaching the whole height of the room, and in many occupying a considerable part of the side of it. A number of these are still in existence in old English Elizabethan mansions, and shew clearly the characteristics of the chimney ornamentation of this period. As the models, however, from which illustration of the modern phases of the Elizabethan chimney which we shall hereafter give have been taken, we shall have occasion again to refer to these.

For the classic chimney-piece we have not the authority of ancient example to depend upon. The ancients seem to have adopted modes of warming by which such a feature was rendered unnecessary, and it consequently does not appear in their apartments; and though we hear of "chimney-tops" in ancient Rome,* the observation probably applies to the terminations of the hot-air flues or relieving shafts of the hypocausts, carried up in the thickness of the walls and opening above the roofs. It is to be observed, that the word chimney-piece is now accepted to mean, and is limited to, the decoration or finish of the opening or recess in the wall constituting the fire-place. Anciently the word chimney appears to have been used to designate a furnace, a stove, or a hearth; and in mediæval architecture, it had occasionally the same application. Later, the term was taken to include the fire-place and flue. In the earliest English chimneys and fire-places, there is but little of the character of the later and modern features which distinguish and properly constitute the chimney-piece. The primitive idea of a simple recess in the wall of sufficient depth and height to be convenient for the making of a fire, the opening covered by an arch, and the sides sometimes ornamented by shafts or small columns, seems to have met the first notions of what was required in this case. Some early chimneys of this kind exist at Rochester and Hedingham Castles, as well as at Conisborough. In the two latter cases there are chimneys which may be taken as shewing the first approaches towards the more distinctive character exhibited in the later examples, whereas at Rochester, and in other similar instances, the fire-places are semicular arched recesses within the thickness of the wall of the apartment. At Conisborough and Hedingham are chimneys projecting from the face of the wall; the hearth or place for the fire being in advance of it, and sheltered above by an over-hanging hood, which sloping back, dies into the wall at some height above. In the first-mentioned case the hood is supported on clustered shafts, projected on a plinth, which support a straight arch that acts as a mantle. In the second, the projecting hood, which is also a straight arch of curious construction is carried on carved corbels, the under parts of which, taking the shape of a moulded shaft, are continued to the ground. At Netley Abbey is

* See Shakespeare's "Julius Cæsar."

another example of the projecting hood, similarly carried upon corbels continued to the ground in projection of the wall, the hood in this instance—as distinguished from the two last, which die into the wall at no great height—rising the whole height of the room. At Aydon Castle is another curious and early hooded chimney, and interesting as being very like many later specimens of the plain projected mantle and shelf, which we still meet with in old farm-houses and other similar erections. It is formed of a plain projecting mantle of stone carried on two plain corbels, and crowned with a cornice, the under splay or facia of which is enriched with carved flowers and heads. The recess for the fire is a simple square recess, the angles of the wall below the corbels being quite unornamented.

The above-mentioned examples shew, as before observed, the earlier approaches to chimney-pieces of the Gothic kind. At a later period, though the general principle of Gothic work is that of recession, and such principle is usually followed both in what are really constructive, as well as other features, we find Gothic chimneys which are still nearer to modern notions and application, and in which the latter takes the form more nearly of a chimney-piece,—that is to say, of an ornamented and projected finish of the fire-place opening, as far even as to the extent of the admission of the mantle-shelf, so customarily looked for and associated with modern uses of the chimney-piece.

In the Hall of the Vicar's Close at Wells, is an example of the shelf in connexion with a fire-place, which in this case, however, is not in projection; but shews the recessed principle, and is of the form more usual at the date of its erection—the 15th century. On the other hand, there are fire-places at Wanswell Court, in Gloucestershire, and in Sherborne Priory, Dorsetshire,* ornamented with chimney-pieces distinctively so to be termed. The former have moulded jambs, arch-headed openings, and a mantle-tree enriched with panels and tracery, supporting a shelf-like cornice, all in projection of the wall of the room. At Sherborne the opening is straight headed, and the mantle, which is of considerable depth, is ornamented with long traceried panels supporting a battlemented cornice, the projection of which acts as a shelf. The return of the projecting sides, the outer angles of which have circular shafts and capitals mitreing with the cornice, have corresponding panels with the face of the mantle, arranged in two heights, the upper agreeing in length with those of the mantle, the latter continued to the floor from the height of the fire-place opening, the angles of which are formed into a hollow moulding studded with carved flowers.

Having so far traced the progress of the Gothic chimney, we will, before entering into a description of the modern illustrations of them given in *Plate* 43, recur to those of a Classic type, which, as before remarked, are more commonly observable at the present day.

For these, as we have already said, we are in want of ancient authority; and, as an author before quoted observes, "Man is in nothing left so much to the dictates of fancy, under the whole science of architecture, as in the construction of ['Classic'] chimney-pieces. Those who have left rules and examples for other articles lived in hotter countries; and the chimney was

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* See Lyson's "Gloucestershire," and "Oxford Glossary, Vol. II."

not with them, as it is with us, a part of such essential importance, that no common room, plain or elegant, could be constructed without it." We will, therefore, in the first instance, have reference in our notice to what are the real requirements of the case, and to the particular parts which modern practice has assigned as those technically and properly belonging to a chimney.

The chimney *per se*, and divested of other adjuncts, is the receptacle, or place, for the fire, with the aperture, or flue, for the voidance of the smoke from it. This latter was, in the first instance, a sloping and ascending cavity in the thickness of the wall, terminating in a loop or other-formed opening on the exterior face of the wall; and later, the flue was carried up vertically to the top of the wall, as common in the present day, and was there finished and capped, in mediæval times, by an almost endless variety of what are called chimney-shafts and caps; with these, however, we have, in connexion with the immediate subject in hand, but little directly to do: our consideration is with that of which these are but the subservient accessories. The chimney viewed as above, therefore, may be taken as an opening at the level of the floor, of sufficient width and height for the making of a fire, and the transmission of its heat to the apartment. This is its essential necessity and appearance; and "thus," says Ware, before quoted, "it appears to us in the first construction of rooms, and thus stands," as he continues, "before the architect to be finished." The form of this opening has had some variety, but at the present time it is usually a rectangular recess, of greater or less capacity, according to size or dignity of the apartment in which it occurs; the superincumbent wall being carried over the opening upon an arch. Such is the chimney in its simple phase of utility; the chimney-piece is properly the ornamentation applied in connexion with this opening, and is so distinguished among the commonly received terms for the several parts into which the chimney is, either in its first and more simple form, or in its added-to and more elaborate character, technically divided. Of these terms, as the A B C of explanation as regards the modern chimney, it will be necessary now to speak. The main divisions are, the lower part, or opening into the room, with its floor, sides, and back, the voiding course, or shaft, for the smoke,—which are the more strictly useful portions,—and the finish, which are the decorations of the first. The lower part is denominated the *fire-place*, its floor being called the *hearth;* that portion which is within the recess being designated the *inner* or *back hearth*, and that in front of the opening the *outer* or *front hearth*, and sometimes *slab*, which is frequently, in rich works, of marble. The vertical sides of the opening are termed the *jambs*, and the term applies equally to the returned surfaces and vertical front supports of the chimney-piece. The back wall is called the *chimney-back*, and the front wall, when in projection of the room, the *chimney-breast*. The conducting shaft for the smoke is called the *flue*, and the lower part of it, which widens or tapers to accommodate the greater cavity of the chimney opening, is termed the *funnel of the flue*—the necessary contraction in the construction at this part being known as the *gathering over*, while the junction of the funnel with the flue itself is called the *throat*. A number of these flues conjoined and carried up together is called a *chimney-stack*, and the part of them which rises above the roof the *chimney-shaft*, or *shafts*, their finish being the *chimney-cap*, or *top*.

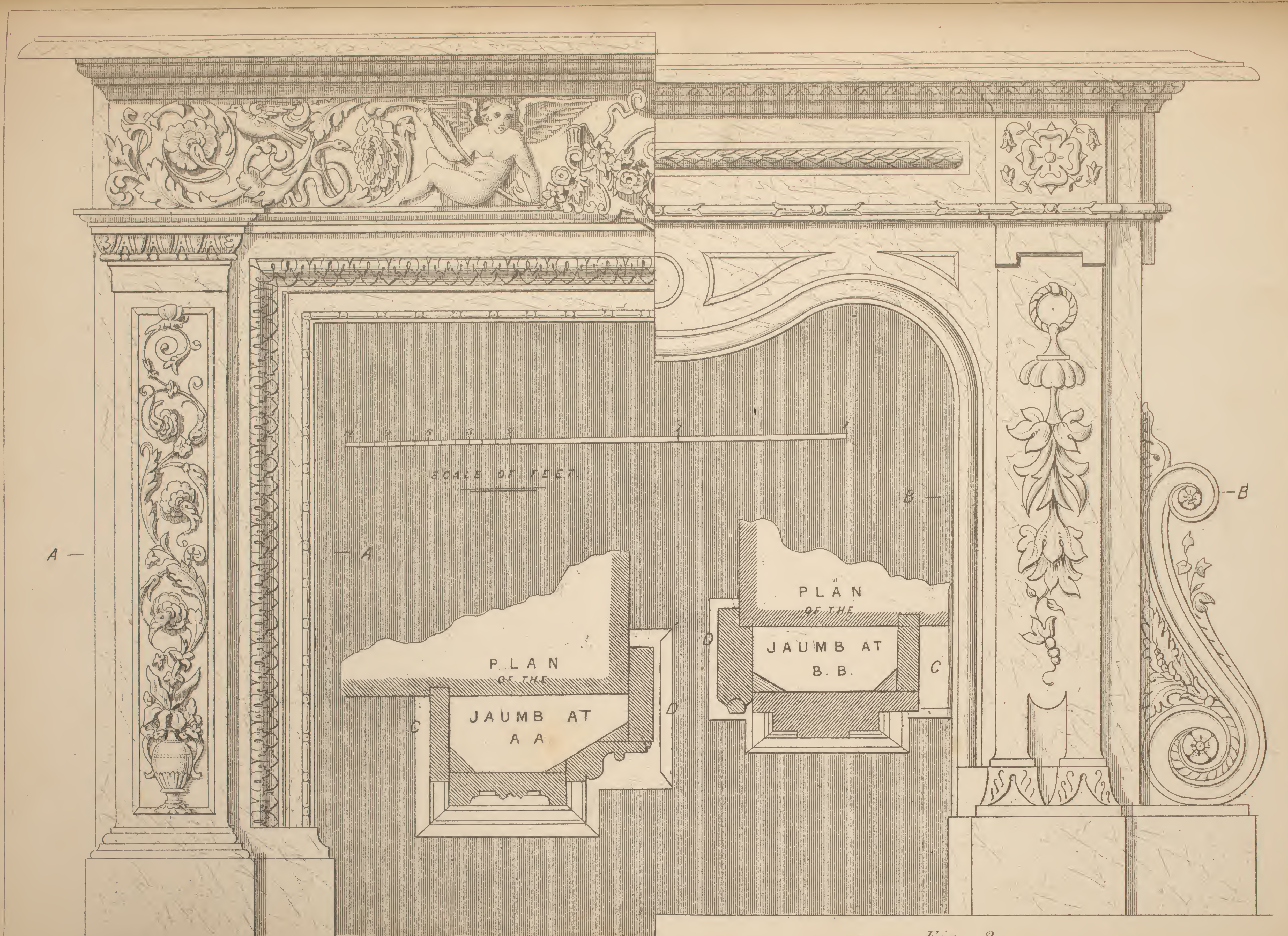


Fig. 1.

Fig. 2.

London, James Hagger, 67, Paternoster Row.

The chimney-piece, or decorative portion round the opening, is, in its more common form and according to customary language, primarily divisible into mantle, jambs, and shelf. The *mantle*, or mantle-piece, is the horizontal portion immediately above the fire-place. This was formerly called the *mantle-tree*, from the use commonly of a timber lintel instead of an arch to cover the opening, as is still frequently seen in old farm and other houses in the provinces. The *jambs* are the vertical additions or ornaments at the sides of the fire-place. Strictly, the term applies to the return faces within the recess, as before noticed when speaking of the chimney-opening by itself; but custom has established it to include the entire portions which support the mantle. The *shelf* is the flat or other projecting slab or cornice forming the covering, or crown, of the mantle. The minuter divisions of the chimney-piece, which originate in the mode in which it is now most usually constructed or put together, will be noticed in the description of the plates.

In designing a Classic chimney-piece, we may properly have full regard to the principle which we have already adverted to in speaking of Classic mouldings in decoration, as distinguishing such from those of the Gothic period, viz., the principle of projection as against recession; not that we do not find many authorities for the projected chimney-piece of Gothic design, but that the greater number of the latter shew the observance of the distinction above alluded to. In the case of Classic doors and openings, the ornamentation of the edges, known and before described as the architrave, is usually laid upon the surface of the wall in which the opening occurs, and is super-imposed or in advance of it; and this system has been, in almost all cases, followed with respect to chimney-pieces in this style. This super-position in modern practice takes, in its first and more simple shapes, that of the plain chimney-piece, formed simply of mantle, jambs, and shelf, having only such projection as the substance of the material—usually from an inch to an inch and a half, according to the thickness of the plaster or wainscotting which covers the wall—presents; the joint or junction of the stone with the plaster or wood being in these cases covered by a moulding, generally of wood. The second form is that technically described as the profile chimney, the distinction between this and the former being that, in this case, the stone-work of the chimney-piece stands wholly in advance of the finish of the wall, shewing a return or *profile* of its outer ends. The projection of these is accordant with the thickness of the stone used, and the jambs are usually formed as pilasters, with a small cap and *necking* moulding under the mantle, the latter finished by the shelf—a *bed-moulding* being sometimes introduced between the two. The next and third form is what is usually called the *box-chimney*, from being constructed hollow or box-fashion. This mode of construction will be at once seen to owe its origin in economy as respects use of material, the latter being applied in thicknesses instead of in the solid. The box-chimney, it will be unnecessary to say, is wholly in projection; and to greater or lesser extent, according to what may be desired. In many cases, the execution of chimneys of this last description—that is to say, according to the design and projection of them in the solid—would be great waste; and it is a very general practice, therefore, to admit this mode of formation even in the best works.

An inspection of the chimney-pieces given in *Plates* 42 and 43[a], which are shewn as exe-

cuted in this mode, will give at once and clearly the nature of this species of construction. In the first of these, the letters C and D, on the respective plans of the two designs there shewn, refer to the minuter divisions of the composition, which we have before stated the plates would explain. C, in either case, represents what is called the *outer* or *outside slip*, and D the *inner* or *inside slip*—the perfected plan, in each instance, shewing a sectional cut through the jamb in its entirety at A A and B B on the elevations. In the case of *Fig.* 1, it will be seen that the jamb is formed of four distinct pieces or thicknesses blocked together, standing in projection of the wall, the interior being hollow or boxed. In *Fig.* 2, the jamb is of three pieces put together in like manner. With reference to the elevation and character of each design, the plate will speak for itself. Each, as there indicated, is of the Classic style, the one being of a rich and elaborate kind, suitable for a drawing-room or other superior apartment; and the other, of a somewhat less ornate description. The material in each is proposed to be marble.

In *Plate* 43, we give two designs for chimney-pieces of a different kind of construction to the last described, and of Gothic character. Both of these are presumed as executed from the solid, as will be seen from the section, *Fig.* 2, and the profiles, *Figs.* 3 and 6. The upper design, as will be seen in the elevation, *Fig.* 1, has a horizontal mantle, ornamented with carved foliage, and a straight fire-place opening, with moulded jambs. The lower, or *Fig.* 2, has an arch-headed recess, and shafts with carved caps and bases on the inner return of the jambs, the spandrels being carved. The shelf is supported by carved brackets from the front face of the jambs. In the case of *Fig.* 1, the front of the jambs is formed into semi-octagon shafts, the caps of which take up and are returned with the moulded shelf. The material best suited, perhaps, for the execution of this latter design would be the finer-grained stones, such as Caen or the best Bath, where marble could not be indulged in. If the size should render more than one stone necessary for the mantle, the latter might be formed on the straight-arch principle, two or more radiated stones being inserted in the horizontal part of the same.

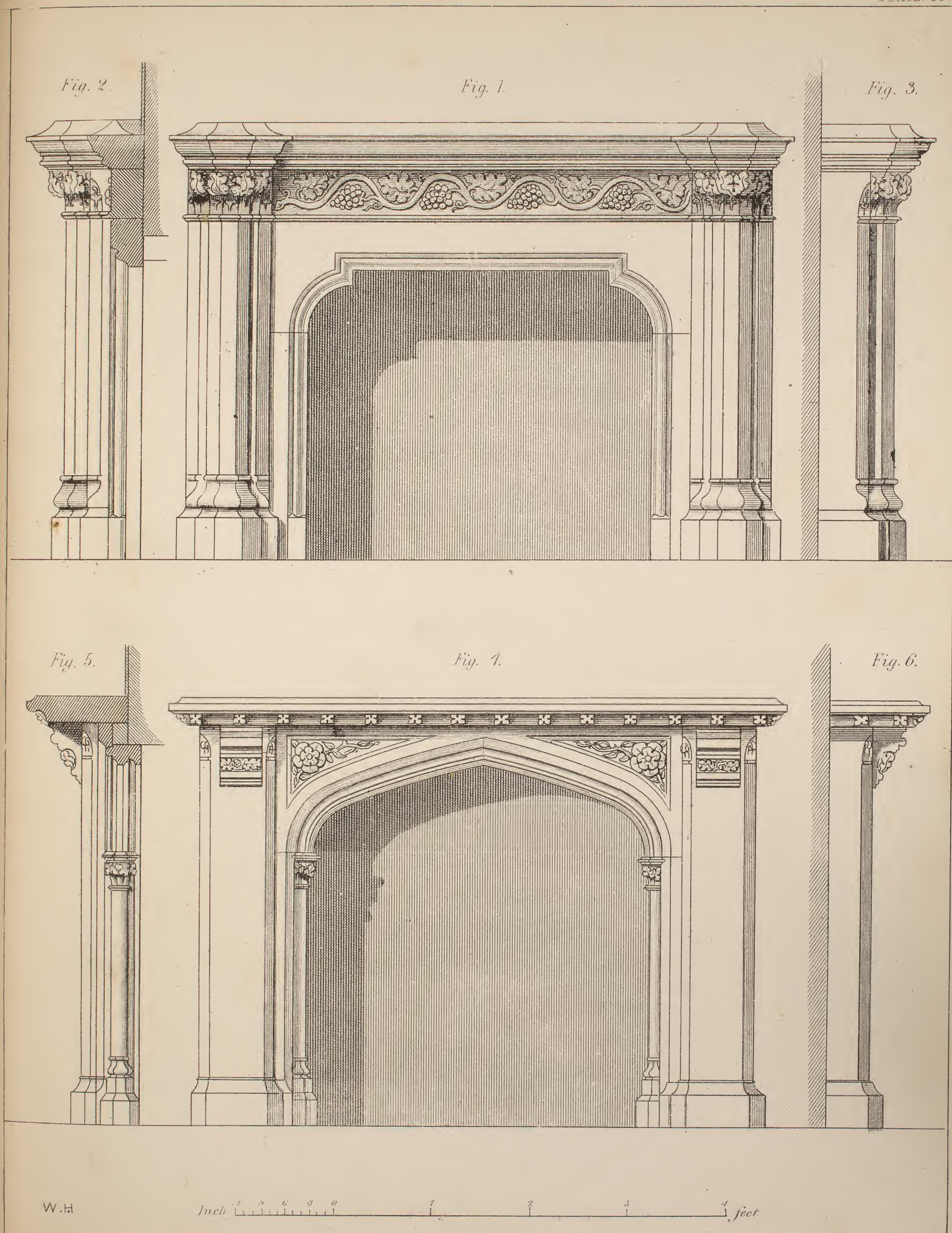
Fig. 1, as will be seen, gives the general elevation of the design.

Fig. 2, is a vertical section through the centre of the opening, shewing the bed-joints of the stones, and the mouldings of the shelf and mantle, &c.

Fig. 3, is the profile of the jamb.

Should marble be the material employed in the execution of this design, a saving might be effected by making the slab bearing the vine-leaf enrichment in thicknesses instead of solid, and either backing with an inferior material or boxing out, as in the case of box-chimneys. A bed-joint might also be made under the top moulding of the shelf, and the lower or under mouldings worked on a separate piece of small sectional area, in a similar manner. In the mantle, however, this would only apply to the space between the jambs. The shafts of the latter might, perhaps, be arranged as attachments to the face; but the caps and bases, &c., would properly have to be worked from the solid.

Fig. 4, is the general elevation of the second design referred to. For this, as for the former, the material might be Caen stone or marble. If applied to bettermost rooms, the former would have the objection of being liable to discoloration, and easily damaged in use. Marble would be,



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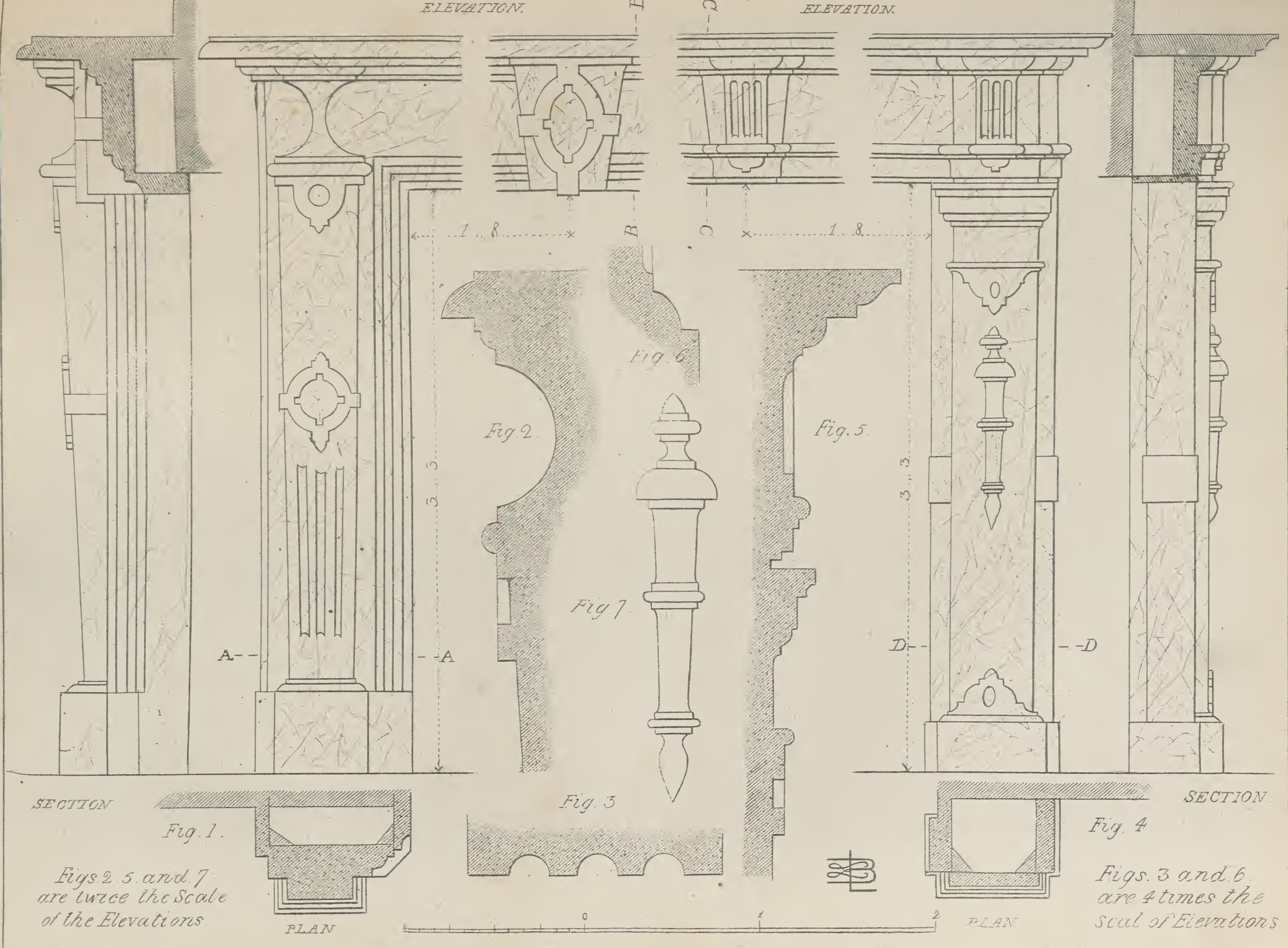


Figs. 2, 5 and 7 are twice the Scale of the Elevations.

Figs. 3 and 6 are 4 times the Scal of Elevations.

for both these and many other reasons, preferable, and the coloured descriptions might be introduced if judiciously chosen. In rich work the carved portions might be of alabaster.

Fig. 5, is the vertical section through the centre of the chimney, and

Fig. 6, the profile of the jamb.

Plate 43*a*, shews, in two designs for chimney-pieces of Elizabethan design, a return to the boxed mode, as respects their construction, as will be observed on inspecting the plan of the jamb in each case. It will be unnecessary to say that in either, however, the solid construction might be adopted where desired.

Fig. 1, is the elevation of one of these designs, with the plan of the jamb taken at A A, and a vertical section taken at B B through the mantle; the central or key-stone of the latter being attached.

Fig. 2, is a vertical section, on an enlarged scale, through the centre of the jamb, shewing the contour of the pilaster on the face of it.

Fig. 3, is a horizontal section through the sinking, or channeling, at the lower part of the pilaster.

Fig. 4, is the elevation of a second design, with the plan of the jamb taken at D D. and a vertical section taken at C C, as in the first.

Fig. 5, is an enlarged section of the upper part of the mantle and jamb, taken through the centre of the pilaster, and the ornamentation over it.

Fig. 6, is an enlarged section of the base moulding of the pilaster, and

Fig. 7, an enlarged elevation of the pendant ornament on the face of the same.

Both these designs might be executed in stone or in coloured marbles. The former has been applied, in Bethersden marble, as a dining-room chimney-piece, with very good effect, and also in Bath stone. The latter, in a mixture of colored and white marble, would make a good drawing-room chimney-piece, at moderate cost.

CHAPTER XX.

ORNAMENTAL MASONRY.

MOULDINGS.—The principal matters involved in the consideration of our first division, or that of Constructive Masonry, having been thus far briefly referred to, we may proceed to a notice of such as are to be classed among the carved and moulded portions, which may be more particularly distinguished as Ornamental Masonry. These require extended attention and study, embracing, as they do, the more strictly artistic consideration and treatment of the general subject. It is the beauty derived from correct form and proportion, in these instances, that

gives to architectural objects, thus enriched, all the pleasurable sensations we derive from the view of them. This appears to have been particularly felt by the ancient Greeks, whose minute appreciation of form is apparent in almost all their works, architectural and otherwise. Greek contour in moulding and Greek outline in enrichment is all but universally admitted as approaching the perfect in art. We have already, in Chapter IV., when speaking of the first of these, said that the Greek architects formed their mouldings from sections of the cone—those of the Roman and the Renaissance periods adopting segments of the circle ; and we have given, in *Plate* 2, forms deduced from the ellipse, the parabola, the hyperbola, and the conoid, shewing their application to architectural features. Recurring to the subject, as we there stated we should, and continuing our illustrations, we give in *Plate* 44 several of the more usual forms of Roman moulding. These, with the examples already given in *Plate* 3, will be sufficient to shew the distinction between the two Classic forms. Of those of the Mediæval or Gothic period we shall take a brief notice, and give a few of the principal forms hereafter.

Figs. 1 and 2, *Plate* 44, exhibit two varied forms of the scotia, from Vignola, with the mode given by him for the delineation or setting out of the same.

Fig. 3, is his method of striking the torus of the Tuscan base.

Fig. 4, illustrates a usual mode of proportioning and finding the curves of the Roman cyma-recta, with its fillet above and customary fillet and hollow below. As will be observed, for the proportions, the height is divided into four parts, one of which is given to the fillet and hollow below, and one to the fillet above—the cyma itself occupying the remaining two ; its projection being three of the same, and that of the lower fillet and hollow one. To find the curves, draw a diagonal line from the upper to the lower points of the cyma ; bisect this line in the usual way, or by the production of a horizontal line from division 2 of the general height, and from the outer points and the point of bisection, with the radius of the bisection—or, in other words, one-half the length of the diagonal, draw the spherical triangles shewn in the figure. The intersection of the lines forming these triangles gives the centres for the upper and lower curves respectively. It may be noted that the diagonal line between the points of the cyma-recta is not indicated on this figure as it is in *Fig.* 5, and the two succeeding ones. Its presence, however, in the latter cases will be sufficiently explanatory as relates to its application in the first.

Fig. 5, gives a second form of the Roman cyma. This is from Palladio, whose general proportions, as respects depth and projection of the cyma itself, as here represented, are the same as the preceding ; the form of the curves, however, being slightly different. To find the latter, the two—that is to say, the upper and base—points of the cyma being found, draw a diagonal line between the two ; bisect the same, and divide one or both portions into seven equal parts. With six of these parts as a radius, from the central and extreme points of the diagonal, describe arcs right and left of the same, the intersections of which will be the centres for the upper and lower curves of the cyma. In the figure, the extremities of the right line crossing the diagonal in the bisecting point, give the positions of the intersecting arcs and the place of the centres from which the curves are struck.

Figs. 6 and 7, are Roman ogees, or reversed cyma-rectæ ; in the first with a plain fillet above, and an astragal and fillet and hollow beneath ; and in the second case, with a fillet and hollow

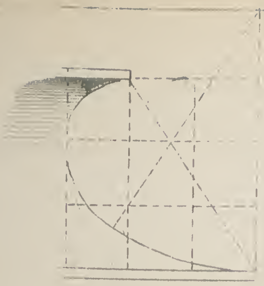


Fig 1

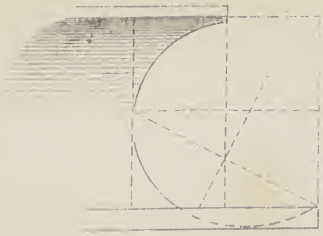


Fig. 2.

Fig. 3

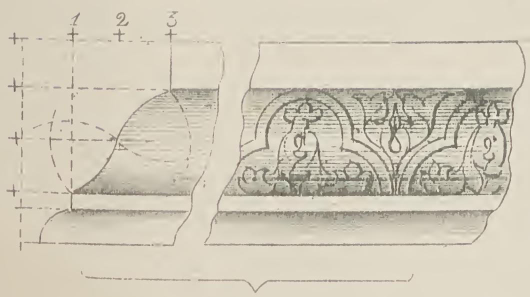


Fig 4

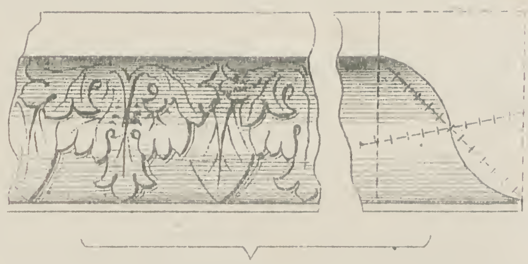


Fig. 5.

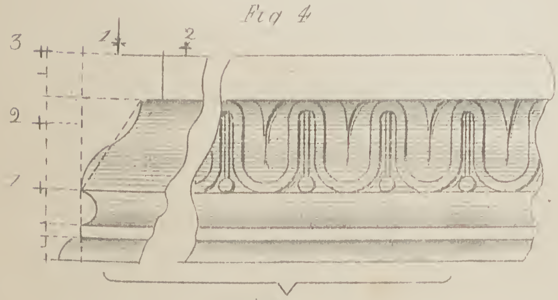


Fig. 6.

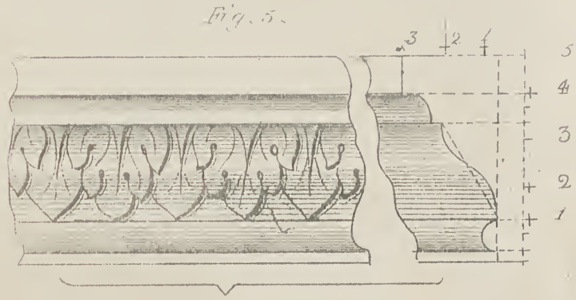


Fig. 7.

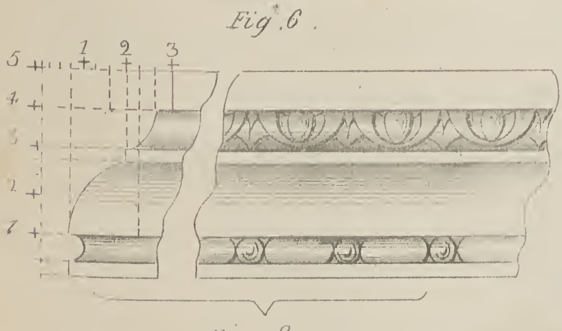


Fig. 8.

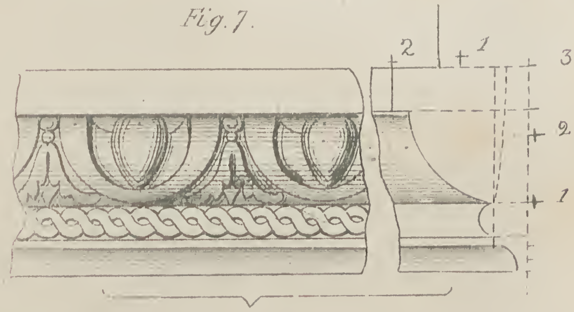


Fig. 9.

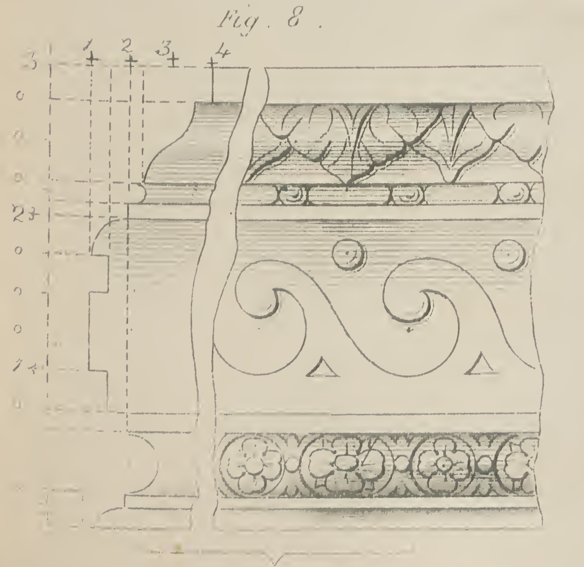


Fig. 10.

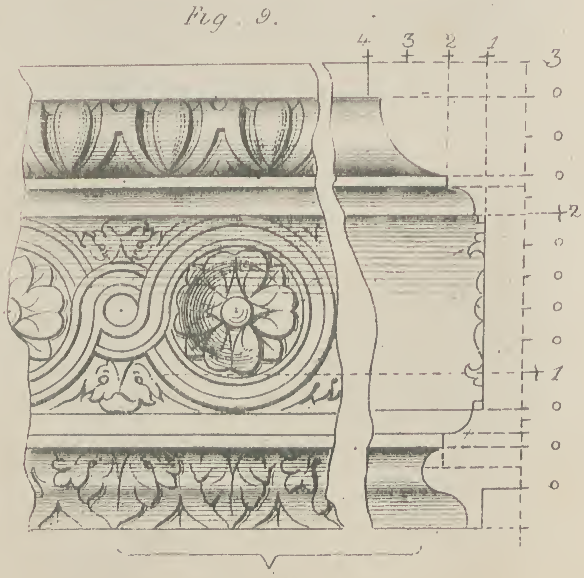


Fig. 11

or cavetto above, and an astragal and fillet below. The curves of the ogee in both are found according to the mode described in *Fig.* 4. The approportionment of the several parts will be readily understood from the figures.

Fig. 8, is the Roman cavetto, with an ovolo and fillet above, and an astragal and under fillet below.

Fig. 9, shews the Roman ovolo, or quarter round, with fillet above and astragal and hollow below. As in the last cases, the proportion of the parts respectively, and the mode of striking the curves in the last two figures, will be easily gained from the illustrations.

Figs. 10 and 11, it will only be necessary to notice as shewing some of the above forms of moulding in combination, and the mode of apportioning the same when so used. In connection with those already given on *Plate* 2, they will be suggestive of many other applications.

In Mediæval mouldings, and ornamentation derived therefrom, the mechanical modes and principles of formation which we have above endeavoured to elucidate, were, as before observed, less considered. Few Gothic mouldings, purely so, are producible wholly by geometric or instrumental means of operation. Most are rather the work, in great part, of the hand, without such aid; and in modern practice, as we before took occasion to notice, this is very largely followed.

Such being the case, rules for the delineation or setting out applicable to the more regular Classic forms can here be only made use of in a modified manner, where the former are embodied, as they are sometimes to a certain extent, in the mouldings of the later periods. In some of the earlier Gothic, the retention of the Roman in combination with other forms of moulding allows of a reference to such means; and the same is the case occasionally in Late Perpendicular work. Under the best phases of Gothic, however, the mouldings are hand-struck almost in all cases.

It would be as impossible as it is unnecessary to enter into illustrations of all the various mouldings, and of the particular cases in which either the one mode or the other is necessarily or advisable to be followed. This is usually determined, as far as the workman is concerned, by the full-sized drawing supplied to him, and from which he works by taking his patterns. On this the mechanical means, if such are used, are generally indicated sufficiently; and for the hand portion, his operation is simply that of either pricking off for, and forming his mould from the paper. To convey to the uninstructed, however, something like a general notion of the forms which have to be dealt with in either case, we will direct attention to the *Plates* 9, and 9*c*, before given, in which several of the most prevalent kinds of Gothic mouldings are sectionally and otherwise exhibited.

These two plates, with that numbered 45, with the elementary lines which are given thereon, and which we shall presently refer to, will be quite sufficient to suggest the most ready modes of procedure in cases where the setting out and execution of similar work may be called for.

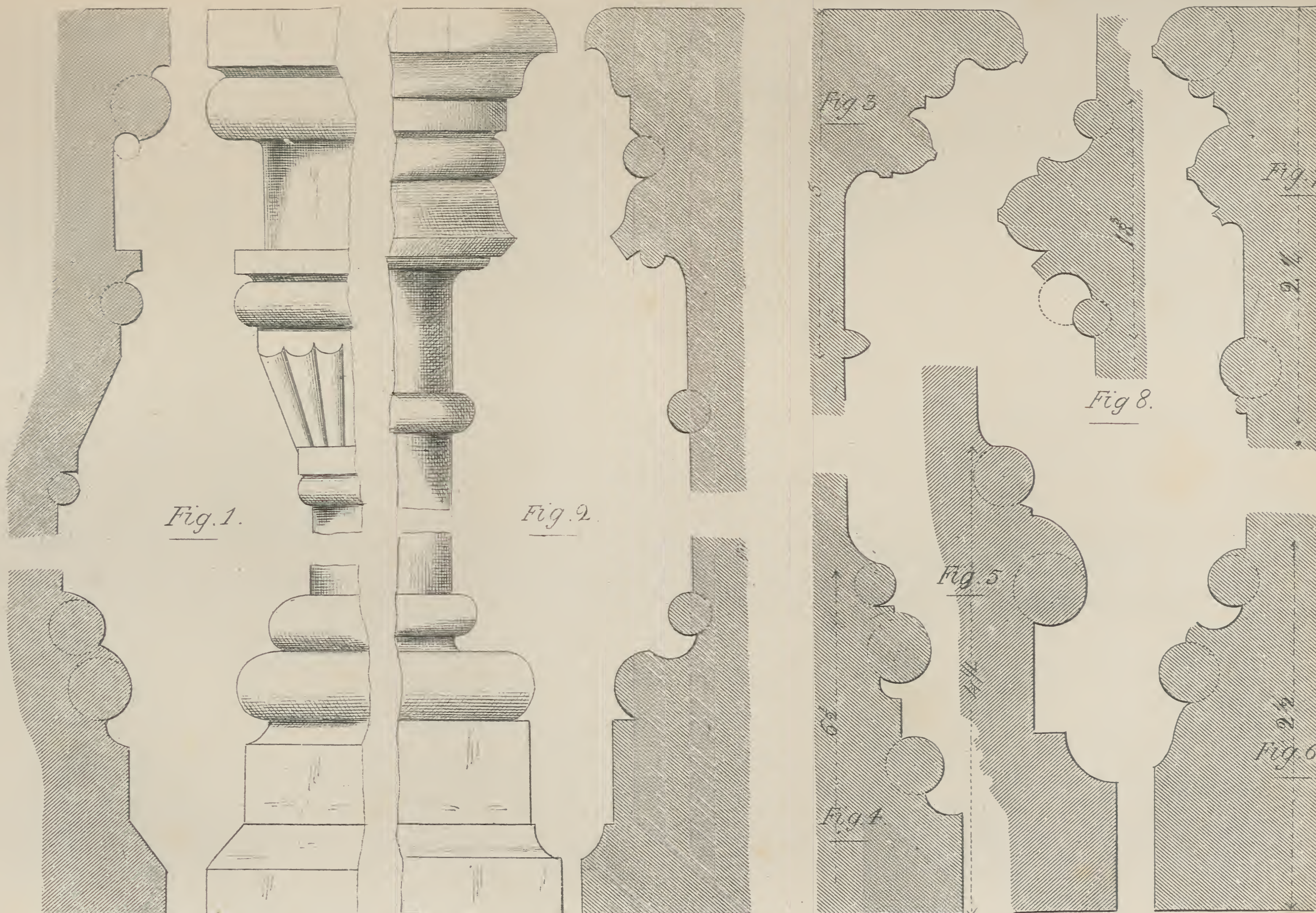
In the first of these plates, *Figs.* 3, 4, 5, 6 and 7, representing mouldings of the Norman period, have all of them portions composed of segments of circles in combination with right lines and other curves. The like is the case, though not so distinctively or to so great an extent, since other parts are hand-worked, and the right line does not enter so freely into the com-

position of the moulding, in *Figs.* 12, 13, and 14, shewing mouldings of the Early English period. In the same category with these last are the six examples numbered as *Figs.* 3 and 4, in *Plate* 9c, being sections of Decorated mouldings, while among the Perpendicular specimens in the same plate there exists an admission of geometric and arbitrary outline, more or less unrestricted and equal.

In *Plate* 45, in the Norman cap and base moulding, *Fig.* 1, there is the same capability of geometric production noticeable in the first-mentioned of *Plate* 9. In the Transitional cap and base, *Fig.* 2, there is less of this. In *Figs.* 3, 4 and 5, Early English mouldings from Cowling, Kent, the portions producible by instrument are few and mostly accommodated, and this is the case very generally with the mouldings of this date. The Decorated ones, *Figs.* 6, 7, and 8, are similarly treated. To Perpendicular mouldings we need not recur, since they are already given largely in *Plate* 9c.

The forms of Gothic mouldings being thus far noticed, it may be thought necessary that something should be said as to the enrichment of the same, as more strictly appertaining to the term Ornamental Masonry. This portion of the subject is the province of the carver, on whose proper knowledge of character and peculiarities of execution in the ornamentation of different periods, and mechanical skill in the representation of the same, a satisfactory result in production is, to a very large extent, if not wholly, dependent. In hardly any point has the architect to trust more to the acquirement and taste of the workman than in this. A drawing, however fully or well defined, can only give an idea, which the operative must mentally fully appreciate the intention of, and practically be able to put into proper material form, with due regard to all those points which constitute its value, either with reference to chronological pretension or artistic merit.

As may be supposed, the earlier evidences of masonic skill in this particular branch fall short of the perfection, either in respect of taste or finish, exhibited in after-instances. The early Norman carvings are, for the most part, rude in design and coarsely executed; and they may be perhaps considered as only to a limited extent applicable to modern use. Later, when grotesque introductions were less indulged in, there are instances of Norman ornament very interesting and beautiful, particularly in the case of adaptations of foliage. There are also adoptions of arbitrary patterns hardly less so, and combinations of the two deserving great attention. To enumerate at length even the principal of these would lead us too far; but we may notice in brief the Norman frets, such as those at St. Peter's, Northampton, Rochester and Malmesbury; Norman scrollwork at Patricksbourne Church, Kent, and the combinations exhibited on the gravestone of Gundreda, at Southover in Sussex, before referred to at page 174, which are but types of very many corresponding examples, not only in this country but on the Continent. France is particularly rich in evidences of Norman carving of the later periods and finer kinds, and this especially applies to their capitals, which are far in advance of those of coeval age here. In such carvings, of a character usually known as the Early English, and also in the Decorated, the French churches and other edifices are likewise very rich, whether in such shape or otherwise; and to this school, or rather to these evidences of French proficiency, as contrasted with the generality of ours, attention has been much directed of late. Not that England cannot



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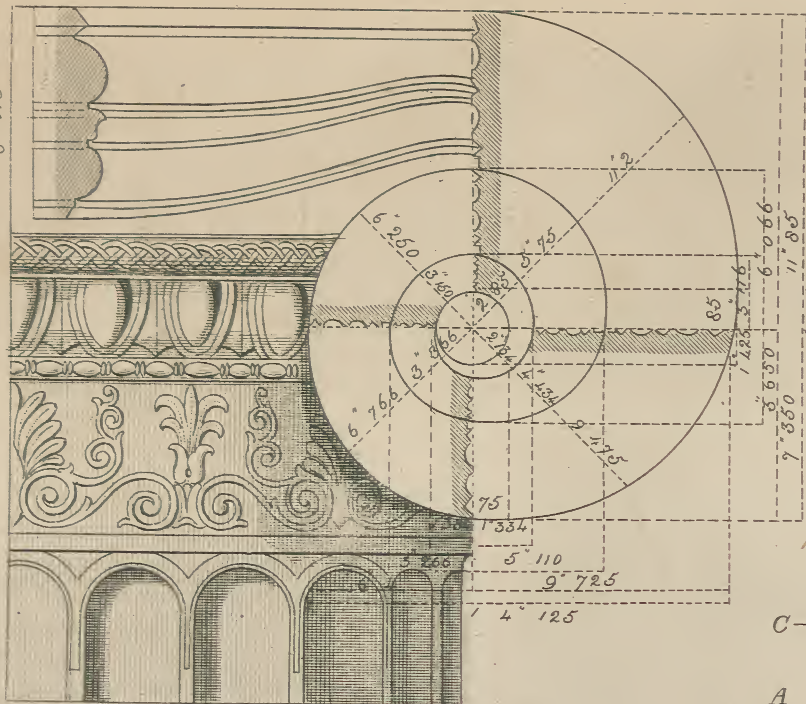
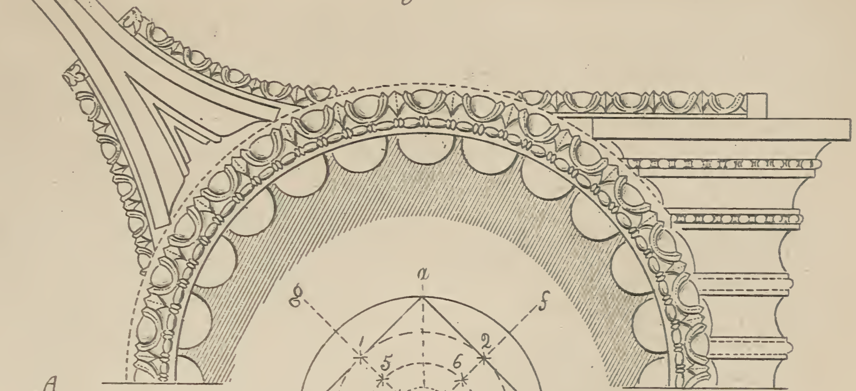


Fig. 1.

Fig. 2.



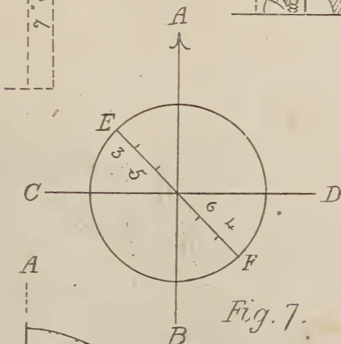


Fig. 7.

Fig. 4.

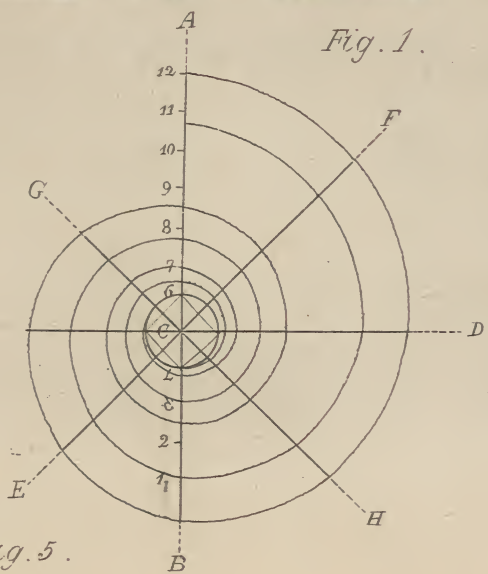
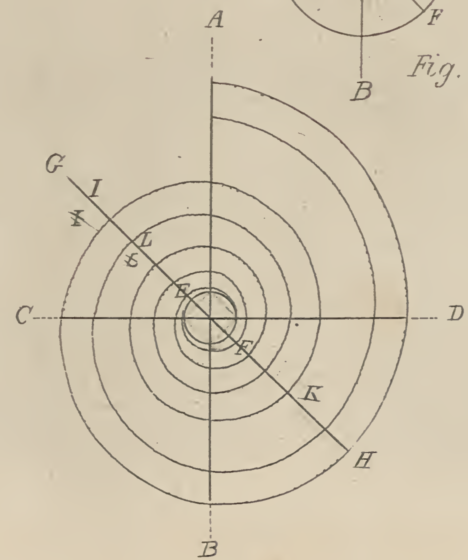


Fig. 5.



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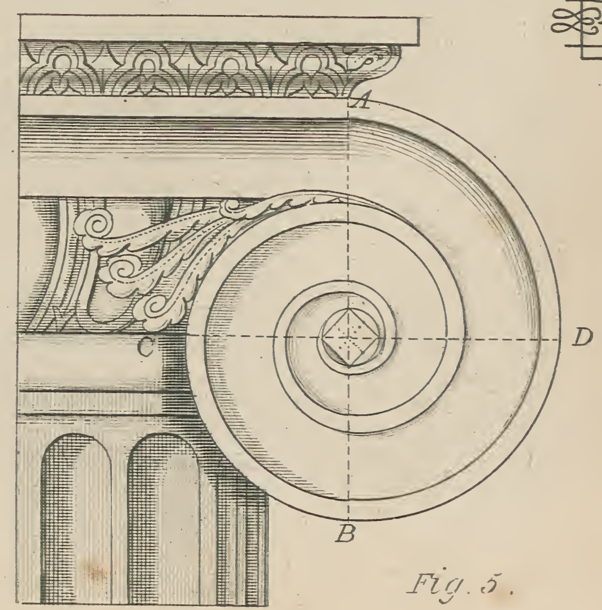


Fig. 5.

shew much that is fully entitled to be considered in this way, and particularly during the Transitional and two immediately succeeding periods; for, of the former age, there exist some very fine specimens, and of the Early English and Decorated an equal, if not greater, number. Of some of these we propose hereafter to give a few illustrations, and for the sake of comparison one or two French examples also of the same kind; but, previously to doing this, we will offer brief observations on, and give a few simple directions in relation to, Classic ornamentation, since such should properly, perhaps, precede the consideration of that of the Gothic, or later kinds.

The shape in which Classic carving and ornamentation most usually comes before the operative at the present day, is that of enrichment to the mouldings, and, as appertaining to the caps of columns and pilasters, &c., belonging to the Classic orders. Other exhibitions of it frequently of course occur, as in the case of arabesques and such-like decoration of panels, friezes, surface-ornamentation of similar kind, and several other features; but these are perhaps less reducible to rule than the first we have mentioned, and depend more upon the exercise of true taste and design in the production of them. The enrichment of mouldings is very varied, and particularly in the Roman Classic. In the Greek, adaptations of what are called the Greek honeysuckle, the egg and tongue, and the interlaced fret, are of usual occurrence. In *Plate* 45*a* some of the latter are shewn, and in *Plates* 3 and 44 some of the prevailing applications in the case of Roman mouldings. The elementary lines of these latter are all more or less to be found by geometric or instrumental operation.

For dealing with the more complicated forms and the enrichments of what we may consider the second division of our subject of Ornamental Masonry, or that which relates to—

CAPITALS, there are, speaking with reference to the Classic—both as respects lineal development and the subsequent practical projection or setting out of the same—many rules of considerable use in simplifying both operations, and on other accounts necessary to be observed. This is particularly the case in the working of the Ionic capital, both Greek and Roman, with its spiral volute, so that the same may have in each case its received proportion and correct form. In *Plate* 45*a* we have given one or two of these, as applicable to the production of the volute; and in *Plate* 45*b* still further enlarged upon the same. In the former

Fig. 1, represents a geometrical elevation of one-half of the Ionic capital of the Temple of Minerva Polias or the Erectheum at Athens, a noted Greek example, with the proportions and spiral lines of the volute in skeleton.

Fig. 2, is the plan of the angular cap from the same edifice, looking upwards.

Fig. 3, is the Ionic volute of Vignola, produced according to the more simple of two modes given by him, and which may be described as follows, viz :—

The eye of the volute, with the cathetus or vertical line of the same, A B on *Fig.* 3, and a b on the enlarged representation of the latter given as *Fig.* 4, having been determined, from the projection of the abacus, or otherwise, and marked on the draft or block as the case may be, draw a line at right angles to the cathetus, C D on *Fig.* 3, and c d on *Fig.* 4, passing through the centre of the eye. Draw diagonals to these two, also cutting the centre, marked e f and g h, *Fig.* 4, and divide thereon the eye of the volute, as indicated by the circular dotted lines on *Fig.* 4; the intersections of which with the diagonals will give the several

centres for the curves; then from No. 1, *Fig.* 4, of these divisions, as a centre, and with the radius 1 A, as applied to *Fig.* 3, describe the quadrant A D. Secondly, from No. 2, *Fig.* 4, as a centre, and with the radius 2 D, describe in like manner the second curve, D B, and so on with the remainder, from the respective centres for the same, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, which completes the spiral.

Fig. 5, in the same plate, is another and somewhat similar method, according to which proceed as follows:—Draw the line A B, and divide the height of the volute into twelve equal parts; draw a line through the seventh division downwards from A, at right angles to A B; and on this line, at D, set off six of these parts (a little more or less, according to the required quickness of the spiral) either to the right or left of the centre, according as the volute is on the left or right; and with one of the parts as a radius, describe a circle about the centre C, which will be the eye of the volute; draw the diagonals E F and G H, bisecting the quadrants. Find the centre for the first quadrant A D on the diagonal G H (which will agree with 1, *Fig.* 4), according to the method shewn on the latter figure; and from 1 as a centre, with a radius extending to A, draw the line of the first quadrant A D; next, from 2 as a centre, with the radius 2 D, describe the second quadrant D B, and so on, as before described for *Fig.* 3, for the remaining portions. For the fillet, set off the breadth of the same at A and D in the same relative proportions as the lines C A and C D; find and mark the centres on the diagonals as before, and proceed in like manner.

Fig. 6, shews a similar means of finding the lines for an angular volute. As in the last case, first draw the line A B, mark the height of the volute thereon, and divide into twenty-three equal parts. Next draw the line C D through the twelfth division from A, at right angles to A B; form the eye of the volute, giving to the diameter of it two of these divisions, and draw a diagonal E F, through the same, as shewn at large in *Fig.* 7; which divide into six equal parts; then from E as a centre, with the radius E A (*Fig.* 6), describe the arc A D H, cutting the diagonal E F produced, in H; then from F as a centre, with the radius F H, describe the semicircle H I, cutting the diagonal produced, in G; again, from 3 (see *Fig.* 7) as a centre, with the radius 3 I, turn a second semicircle I K, cutting the diagonal G H, in K; next, from the centre 4 (see *Fig.* 7), with the radius 4 K, describe the semicircle K L; and lastly, so on with the remaining centres 5 and 6.

The other convolutions forming the fillet are to be described in a similar manner, by fixing their respective centres on the diagonal.

The above directions, as will be seen, refer particularly to the projection of the curved lines of the Ionic volute. With relation to the general proportions of this feature, and of other parts of the perfect capital, we give in *Plate* 45*b* an illustration of the rule of Gibbs, which, as a simple one—and, like the rest of his rules, divested of much unnecessary minutiæ—will be found useful in the elementary processes first required.

Fig. 1, in the plate here referred to, is an elevation of one-half the Roman Ionic capital, as set out by him according to the following method:—Draw the centre line of the capital, and another at right angles thereto, which shall represent the upper part or surface of the same; let fall the line A B parallel to the centre line, and for the height of the capital mark thereon

CAPITALS &c. CLASSIC.

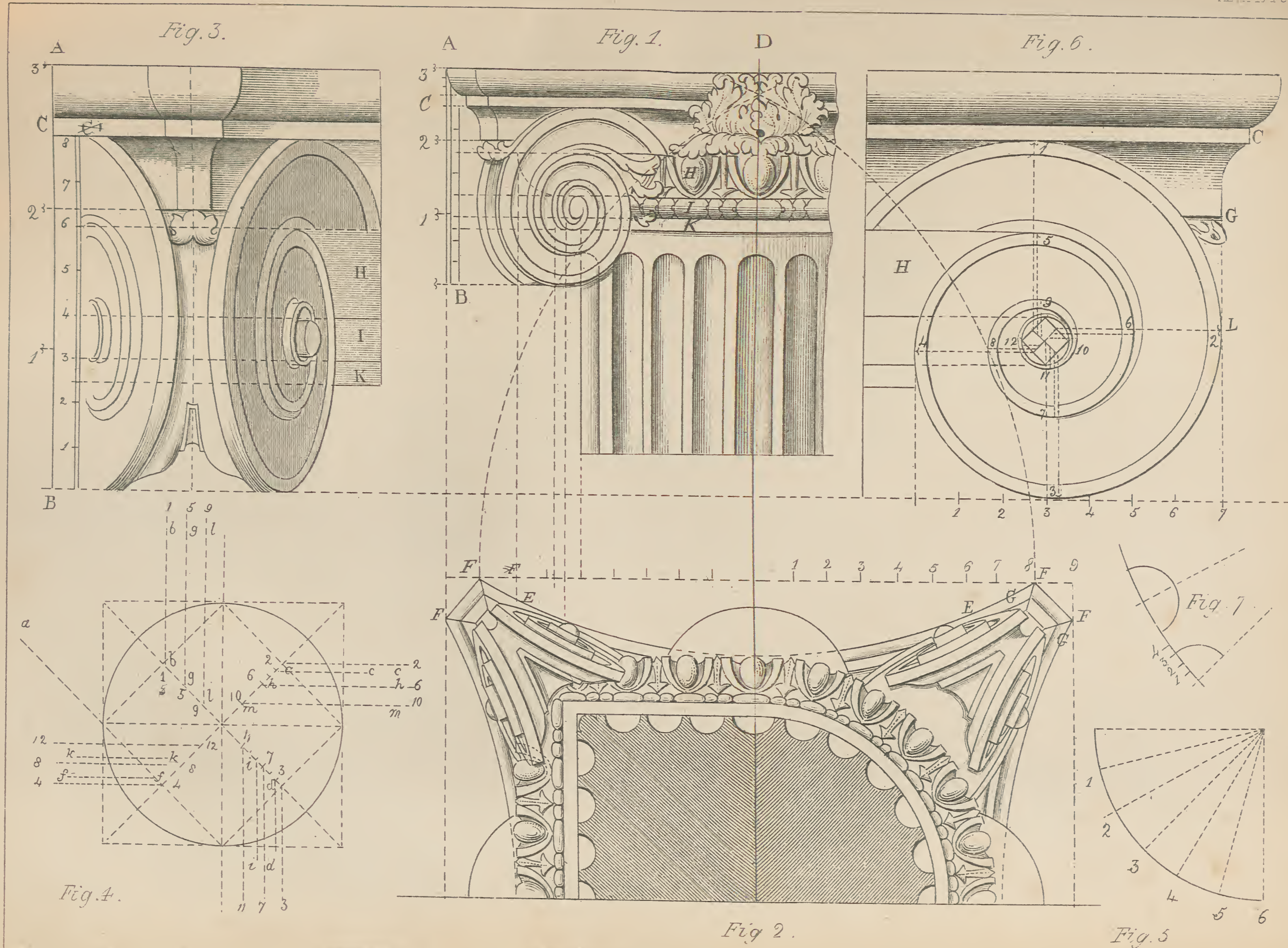


Fig. 3. Fig. 1. Fig. 6. Fig. 4. Fig. 2. Fig. 7. Fig. 5.

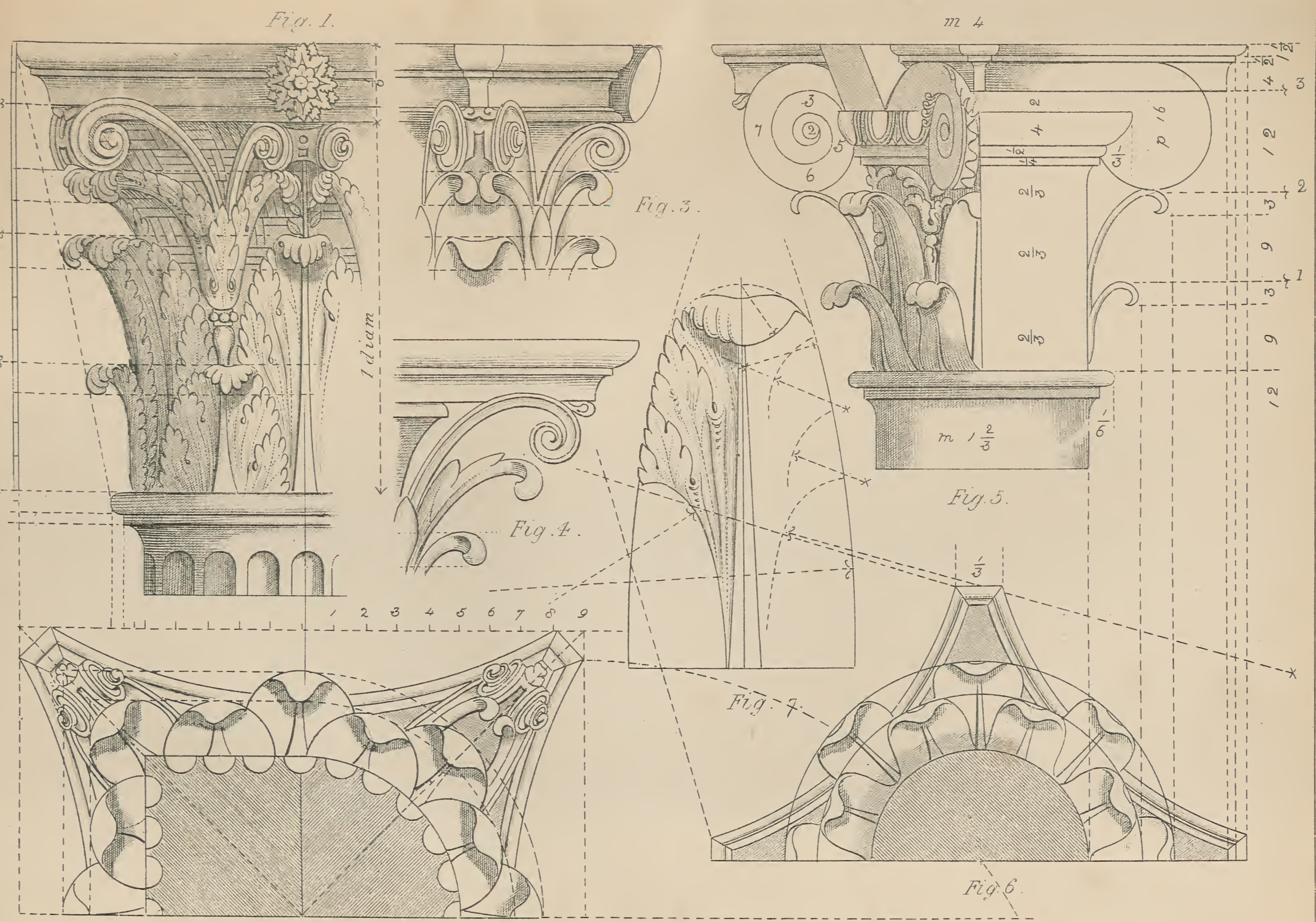


Fig. 2.

one-half the lower diameter; that is to say, six of the parts marked on the projection of the plan of the capital, *Fig.* 2. Divide A B into three parts, as seen on the figure; give one of these parts to the abacus; and for its subdivisions, first divide into two parts, the lower one of which give to the cavetto of the abacus; next divide the upper half or part into four parts, three of which must be given to the ovolo, and the fourth to the listel or fillet C; then divide the height B C into eight parts, give two of them to the ovolo H, one to the bead I, which answers to the eye of the volute, and one-half a part to the fillet K.

It should be observed that the height of the volute being divided into eight parts, its breadth or projection should be seven, and that the extreme of the latter should be plumb, that is to say, in the line with the under part or angle of the abacus, as shewn at G on *Figs.* 2 and 3.

Fig. 2, exhibits the half plan of a column, and a half plan of a pilaster, with the angle volute to each. To project this, Gibbs' rule is in substance as follows, viz.:—Divide the lower diameter of the column into twelve parts; take five parts for the diminished or upper semi-diameter of the same, which will be also that of the pilaster, and draw in as shewn on the shaded portion of the plan of each. From the profile of the elevation of the capital, shewn completed in dotted lines on *Fig.* 1, let fall the projection of the ovolo, bead and fillet, and mark them on the plan. Then form a square at the extremity of the projection of the capital, the extent of which should be eighteen parts, three being added on each side to the lower diameter of the column. Set off at each angle one of these parts—that is to say, a sixth of the half diameter—and with a radius equal to the remaining number of parts, viz. sixteen, mark the intersection, as shewn in dotted lines from *Fig.* 2, at D. From D as a centre describe the segment E E, *Fig.* 2, forming the cavity of the abacus; draw the diagonals F F, cutting off the square angles of the abacus, and set off one-sixth part for the two members thereof; divide into two parts, give one to the cavetto, or lower moulding, and one to the ovolo; unite the angles F G, and return the members parallel to the outer segment.

Figs. 3, represent the volute as viewed in front and on the angle, to a scale twice that of the elevation and plan. In each the division of parts and the letters correspond with those on *Fig.* 1. On the front view the several centres for the curves are indicated, agreeably to the enlarged representation of the eye, given to an increased scale, for the sake of greater clearness, in *Fig.* 4. This latter figure shews Gibbs' rule for finding the spiral lines, which does not differ very materially from that before given in *Plate* 45*a*. It is as follows, viz.—

Divide the height of the volute B C, on the angular view, *Fig.* 3, into eight parts; give the space between the third and fourth part to the eye of the volute, and bisect this for its horizontal centre; then draw a horizontal line indefinitely from B, at right angles thereto, and mark thereon (see front view, *Fig.* 3,) seven of the parts or divisions of the vertical line B C, which will give the breadth or extent of the volute, when a perpendicular produced upwards from the third division will give the vertical centre of the eye. Next draw the circle of the eye (see *Fig.* 4), the enclosing square, and the diagonals of the same, as shewn in dotted lines, (*Fig.* 4.) Then, parallel to these diagonals, form the inner square, and divide so much of the length of each diagonal as is included within the last-named square, into six equal parts, marked respectively 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12. Then with 1 (*Fig.* 4) as a centre,

describe the quadrant 1, 2 (front view, *Fig.* 3). Next, with the centre 2 (*Fig.* 4), describe the second quadrant 2, 3 (*Fig.* 3), and so on with all the remaining centres and quadrants, till the outer spiral line is complete. The inner spiral runs parallel to the outer, to centre 3, and the breadth of the fillet formed by it is a half of one of the divisions of the height B C. The centres for the inner spiral are marked on the diagonals (*Fig.* 4) with the letters *a*, *b*, *c*, *d*, &c., and the proceeding with them is the same as with the outer line. The portion of the spiral from its issue from the ovolo to the commencement of the first quadrant at 1, is struck from the salient angle of the inner square of the eye, shewn as *a* produced, on *Fig.* 4.

It should be added, in relation to this latter figure, that the vertical and horizontal dotted lines distinguished by *figures*, produced upon the diagonals, mark the centres for the outer spiral; those distinguished by *letters*, also produced upon the diagonals, in like manner mark the centres for the inner spiral line.

Fig. 5, shews the mode of apportioning and finding the centres for the flutings of the column, which may be described as follows, viz.—Divide one-fourth of the plan of the column into six equal parts (see *Fig.* 5), which will give the centre of each flute, the total number round the column being 24. Then divide the half of one of the six parts into four, and take three for the semi-diameter of the flute, as shewn in the enlarged diagram above *Fig.* 5. The breadth of the fillet between the flutes will be, as there seen, two of these latter mentioned parts, or one-third of a flute.

Our next *Plate*, 45*c*, illustrates, in a similar manner to the two last, the mode of projecting the Corinthian and Composite capitals.

Fig. 1, is the geometrical elevation of a portion of a capital of the first-mentioned order, with the proper apportionment of its several parts indicated on the line A B, at the side thereof. The divisions 1 and 2 of this line shew the height of the lower and middle leaves, the projection of the curl of which should not extend beyond a line drawn from the ovolo of the abacus to the extremity of the astragal, as is shewn by the dotted line on the figure.

Fig. 2, as in *Plate* 45*b*, shews a half plan of a pilaster with its capital, and a half plan of the column and its capital. The mode of projecting these plans from the profile of the capital, being similar to that described with reference to the Ionic, in the last plate, it will be unnecessary to repeat the directions for them.

Figs. 3 and 4, are front and angle elevations of the caulicoli in their more simple or elementary form.

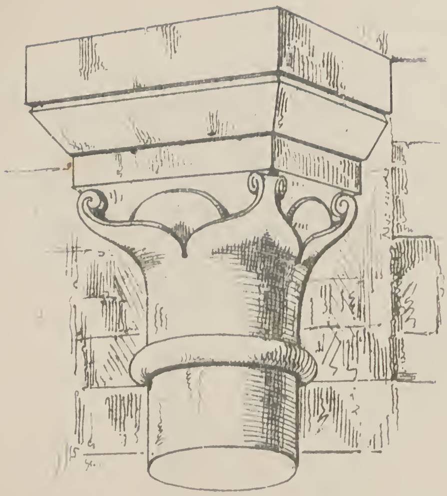
Fig. 5, is a geometrical elevation of the Composite capital of Vignola, viewed on the angle, and shewn in different stages of development.

Fig. 6, is the half plan of the same, the lines of production being drawn from the profile above.

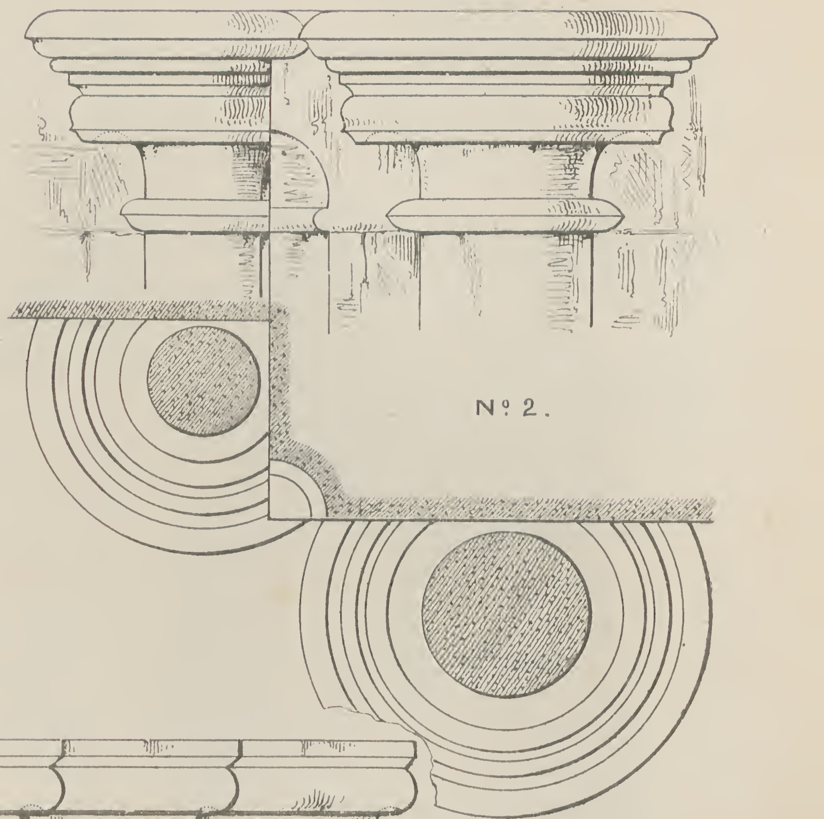
Fig. 7, shews an enlarged elevation of the superior leaves of both capitals, with the elementary lines for their subdivision.

Having so far noticed the application of Classic ornamentation, or carving, to capitals, as the form in which the same is more commonly called for at the present day, we recur to the similar works of the Mediæval period, to which we have previously alluded.

CAPITALS, GOTHIC STYLE.



N° 1.



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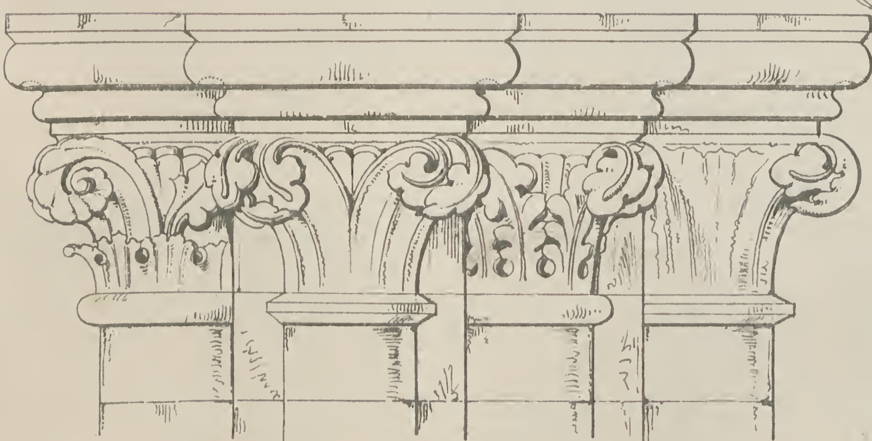

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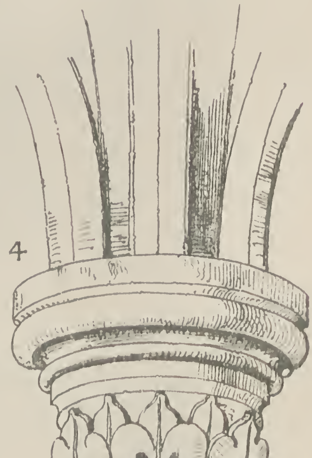

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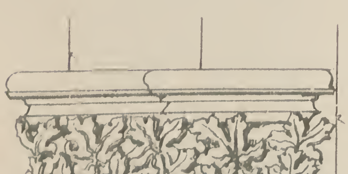
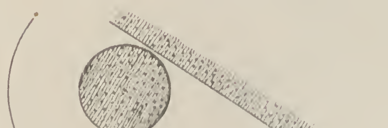




N° 5

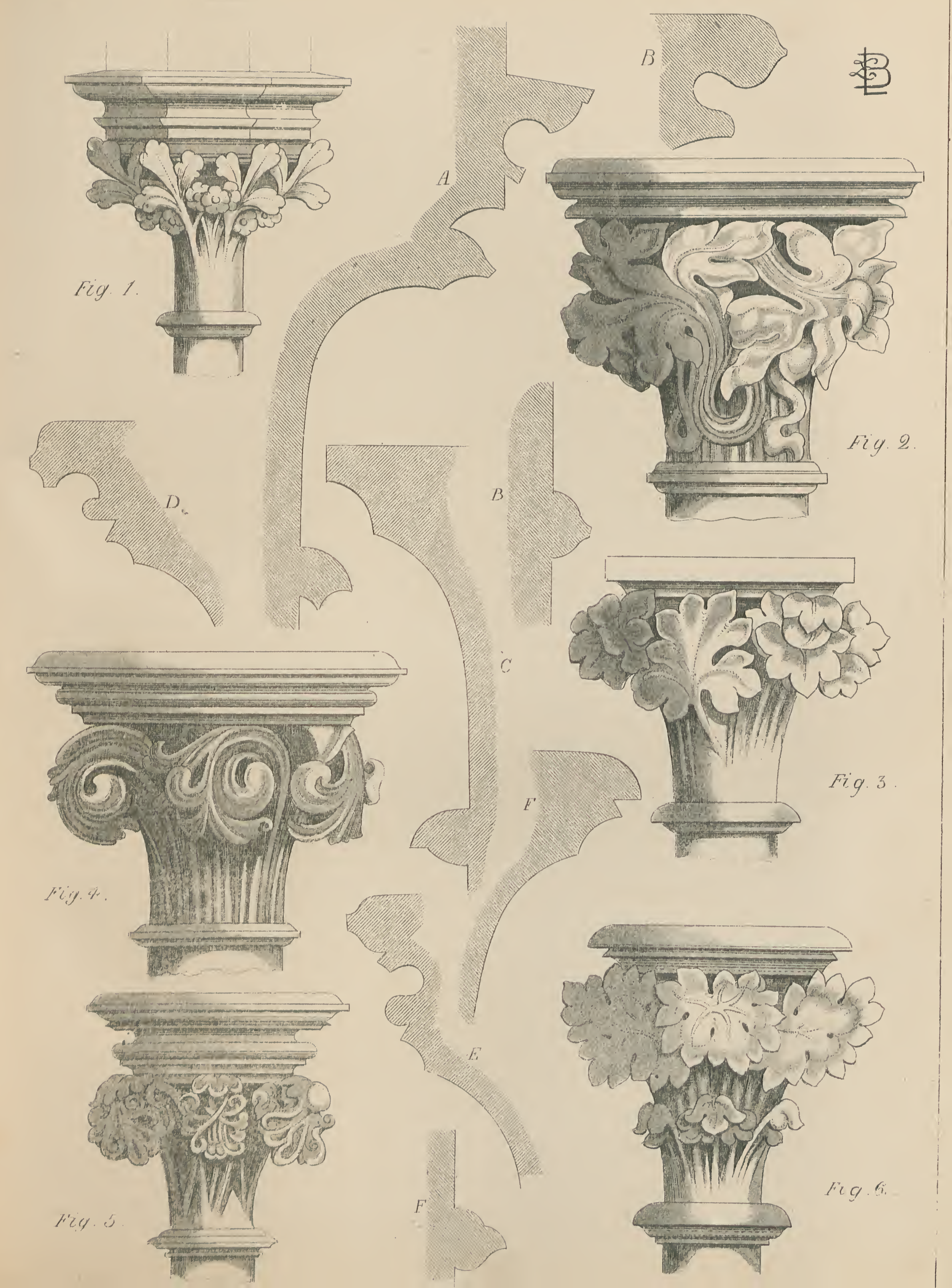
Dan^l Raddle, del^t

0 1 2

SCALE OF FEET

London James Hagger 67 Paternoster Row

CAPITALS—GOTHIC.



The ornamental masonry exhibited in Gothic capitals and work of a like description, is of such unlimited variety as to preclude the possibility of more than a reference to the general features and principles which more particularly distinguish the specimens of the several periods. To such, therefore, we must limit our notice, leaving the fancy and taste of the workman free, as would appear to have been the old practice, to adapt or execute according to purpose required, upon the same basis.

As before observed, the earlier evidences of carved ornamentation, both in capitals and otherwise, were rude and untasteful. Towards what is denominated, in reference to English architecture, the Transitional period, however, the forms and designs are far improved. At this date there is a large reference to, and adaptations of, foliage, and this continues in increasing amount throughout the two succeeding eras—the Early English, and Decorated—many of the capitals of all these periods being very beautifully enriched in this way. In the Transitional there are, in many instances, and particularly abroad, clear indications of old Classic types having been referred to in the design of them. Two of this date, respectively from Soissons Cathedral, and from St. Nicholas Church at Blois, given in the "Oxford Glossary," *Plate* 29, shew this very distinctly, as does an early English one, also from Blois, given in *Plate* 30 of same authority; while in this country several of the capitals of the choir columns at Canterbury afford parallel example. As regards these latter, it is to be observed, that they are the work of a foreign architect, and consequently partake to greater extent of the foreign element than appears generally in native examples at this time. One improvement is, however, common to both, and that is a less stunted proportion. The Norman capitals, and the earlier Transitional specimens following them, do not exhibit the height of bell general in the later examples of the latter style. This is, to a very large extent, a foreign peculiarity, and is the result, doubtless, of influence from such a source,—being retained in introduction here, however, to far less degree than it is to be wished had been the case, in the styles which followed. While speaking of this as one of the improvements in form characteristic of the Transitional examples, it may be noted, that the depth of the capital is a great element in the beauty of the foreign ones, both as respects themselves and as contrasted with the English. To be satisfied of this, it is only necessary to compare the capitals numbered 1 and 4 on *Plate* 46, and those figured as 1, 3 and 5 on *Plate* 47, with those numbered 2, 3 and 5 on the former, and those figured 2, 3 and 4 on the latter. The first, or No. 1, *Plate* 46, is a very early Transitional, if not actually late Norman, capital of this sort; and the second, or No. 4, is late Transitional, having still further a foreign treatment in the number of the mouldings contained in its abacus. As contrasted with the elongated character of these, in No. 3 is a group of Transitional capitals, and in Nos. 2 and 5, others of early and late Decorated, in which the less agreeable proportion is retained. Of these latter, the first-mentioned, as will be perceived, are plain moulded capitals, and the second, foliaged capitals of the usual type of the time.

In *Plate* 47, *Figs.* 1, 3 and 6, with their respective sections A, C, and F, are early capitals upon the French model, for comparison with *Figs.* 2, 4 and 5, and their sections B, D, and E, English specimens, respectively from Lichfield, Westminster, and Durham, the two latter of Early English date, the former Decorated. Of such as the first there are innumerable varieties

in the French and German churches; and towards the middle of the thirteenth century, they are for the most part of great beauty—the elongated character of the bell being carried in many instances to the utmost extent. A capital given by Violet le Duc, in his "Dictionnaire Raissoné de l'Architecture Française," from a window in one of the apsidal chapels of Notre Dame de Paris, is a striking evidence of this, and there exist very many similar instances.

The English examples, given in our plate, exhibit the admission of this tendency rather more largely than in many other cases; and in that of the Lichfield one this is interesting, since the general character of the design, and of the ornamentation in this building, is noted as approximating more nearly to the French than any other of our cathedral edifices. In respect to the mode of introduction, and the character of the foliage, there is at Lichfield, and occasionally in other cases, a great similarity. The same sources, that is to say, natural production in vegetation, seem to have been in the first particularly, and in the others often, referred to. This is much earlier developed in French architecture than English, since it appears more generally in the Decorated period of the latter than in the preceding, though Early English capitals and ornament exhibit it frequently, but after a less natural fashion, as is commonly the case, more or less, with the earlier French specimens, which are, with few exceptions, conventionalised imitations of the natural flower or plant, as the case may be, and, as has been remarked, proceed from it, though they are not to be associated specially, or in species, therewith. Later these conventional representations gave way to more strictly natural ones.

The "Oxford Glossary," speaking of Early English capitals, says "they are very frequently entirely devoid of carving, and consist of suits of plain mouldings, generally not very numerous, which are deeply undercut, so as to produce fine bold shadows;" and, referring to the lengthened proportion we have been alluding to, adds, "and there is usually a considerable space, or *bell*, between the upper mouldings and the necking; occasionally a series of the toothed ornament, or some other similar enrichment, is used between the mouldings." In specimens where, says the same authority, "foliage is introduced, it is placed upon the bell of the capital; and, for the most part, but few, if any mouldings, beyond the abacus and necking, are used with it; the leaves are generally somewhat stiff in their character, but almost always stand out very boldly, so as to produce a very striking and beautiful effect, and they are generally very well worked, and often so much undercut that the stalks and more prominent parts are entirely detached. The character of the foliage varies, but by far the most common, and that which belongs peculiarly to this style, consists of a trefoil, the two lower lobes of which (and sometimes all three) are worked with a high prominence or swelling in the centre, which casts a considerable shadow; the middle lobe is frequently much larger than the others, with the main fibre deeply channelled in it. Occasionally animals are mixed with the foliage, but they are usually a sign that the work is late."

In the French and other foreign capitals of a date coeval with the above, when, as before remarked, conventionalism became less fixed and arbitrary, we find in many instances a very close adherence to nature, as was the case with our own later works of Decorated date, in which particular French architecture only shews a similar advance over that of this country to that which we have already referred to as apparent in other points. Violet le Duc gives the

middle of the thirteenth century as the period when this departure from the earlier kinds of ornamentation in capitals was in the main established in France; the first marked tendency in such direction occurring about 1230. Among the introductions of this time he notices imitations of the foliage of the oak, the maple, the pear, the fig-tree, and the beech, together with the holly, the ivy, the vine, the briar, &c., in all of which the reference to nature was more or less unrestricted and distinct.

In England this recourse to, and close imitation of natural objects, such as those above referred to, is a distinguishing mark in Decorated ornamentation, and it is one on which we have enlarged somewhat, because of the extreme prolificness of the field for adaptive purposes, and the beauty that may be culled therefrom. To all the points, indeed, in connection with the general subject of the enrichments applied to capitals and such-like carvings, which we have taken occasion to observe upon, it is in all respects necessary that the masonic artist should direct his close attention. Nothing is more essential than that he should be fully cognisant and alive to the style and character of each succeeding period he has to imitate. The value of his work is dependent upon the manner and extent to which he embraces the several peculiarities and distinguishing features of each—not that he may servilely copy, however, but that he should endeavour to imbibe the principles upon which such were and are to be applied, and, by reference to the same inexhaustible sources, produce new combinations bearing in all the essential elements the like impress, the like originality of thought, and, in the case of professed imitations of a particular period, the corresponding character of detail and execution.

Further applying these observations in their reference to English work, we again quote the "Oxford Glossary," which, describing Decorated capitals, says that the same "very often consist of plain mouldings, either with or without ball-flowers, or other flowers worked upon the bell, though they are frequently carved with very rich and beautiful foliage; the mouldings usually consist of rounds, ogees, and hollows, and are not so deeply undercut as in the Early English style; the foliage is very different from Early English work, and of a much broader character, many of the leaves being representations of those of particular plants or trees, as the oak, ivy, white-thorn, vine, &c.;"—thus agreeing with the French examples before noticed,—"which are often worked so truly to nature as to lead to the supposition that the carver used real leaves for his pattern; they are also generally extremely well arranged, and without the stiffness to be found in Early English foliage."

In the succeeding or Perpendicular period "capitals are most usually plain, though in large and ornamental buildings they are not unfrequently enriched with foliage, especially early in the style." In character, "much of the foliage bears considerable resemblance to the Decorated, but it is stiffer and not so well combined, and the leaves in general are of less natural forms; towards the latter part of the style there is frequently a main stalk continued uninterruptedly in a waved line, with the leaves arranged alternately on opposite sides." As a specimen of this applied to a capital, the "Glossary" refers to and gives an example from Upwey Church, in Dorsetshire. Applied to Gothic friezes, or rather plain faces so answering, cornices, hollows, panelling, and other features, this kind of ornamentation is very prevalent. Among many others that might be mentioned, there is a very good example on the middle rail of

the chancel-screen at Trunch, in Norfolk, and some beautiful carving on the same principle occurs at East Harling in the same county.

Among the many other and similar shapes in which Mediæval carving and ornamental masonry appears, having thus far dealt with capitals, may be enumerated

CORBELS, BOSSES, CROCKETS, &c.—the former particularly, as having, in many instances, nearly the same uses as capitals, and as exhibiting in such cases a parallel description of treatment. The term is considered as peculiar to Gothic architecture, and is defined, in a general sense, to be a projection of stone or other material, supporting a superincumbent weight. Violet le Duc says, the true origin of the corbel is given in the projection presented by a joist, or other timber of the kind, beyond the plain face of a wall, for the purpose of carrying a front of wood, the timber-work of a roof, or a post, &c. The Romans of the lower empire, he says, adopted corbels of stone and marble as supports, in projection of the walls, to decorative features, such as lesser orders so introduced, architraves, and the overhanging faces of cornices, strings, &c.; and, in their turn, the architects of the Gothic period made use of them in a number of cases with success. Their origin being in, and having reference primarily to a timber construction, the details and forms given to carpentry are preserved and imitated in those corbels which were subsequently formed in stone, and this is apparent very largely and distinctly in foreign examples. In England the principle of the projecting timber-support is exhibited clearly and ordinarily in the Norman corbel-table, and in the case of many specimens of such, the treatment of the detail and arrangement of the carving is equally agreeable with the reference and practice observable abroad. According to the style of the period and taste of the age here, however, corbels were used in great variety, both of form and design, as well as in a number of other situations than those to which they primitively were principally applied. As supports for the ends of main timbers of floors, the machicolations of towers, the shafts of roof-groining, the labels of doors and windows, &c., such are of common occurrence, and they present, and are suggestive, in the majority of cases, of an almost endless variety of combination.

In the Early Norman corbels, grotesque heads and other ornament of like kind are an extremely prevalent feature, and the carving is wholly, with few exceptions, on the face of the corbel, the sides showing a plain sectional cut of the outline. Later, particularly in the case of corbel-tables, the faces are moulded in various bold forms, in many bearing great resemblance, viewed from a distance, to the human countenance, but on closer approach shewing a mere moulded arrangement, and the same sectional contour of the side before described. These latter are very common in the Transitional period, and are a great improvement upon the, in most cases, hideous representations which preceded them. This peculiar treatment and preservation of the profile of the corbel appears longer retained in the French examples than in ours. In the Early English specimens, both of the corbel-table and the corbel simply, it is less considered. The terminations of the arches, which, at this period, usually form the corbel-table, are, for the most part, knots of sculpture, treated after the same fashion as that species of corbel which is called by the French, without the justification of good reason, as Violet le Duc says, *cul de lampe*,—that is to say, moulded or carved on the front and the return faces,

or all round, according as the plan may be square or spherical, &c. The "Oxford Glossary" gives three examples under the head of Corbels, which very clearly identify the distinction made by the French architects between the two fashions or species of corbel here referred to. The one is from Northmoor Church, Oxon (circa 1320); and the two others, respectively from Kirkstall Abbey (1150), and Haseley Church, Oxfordshire (circa 1200). Other examples there given, such as those from Merton College, and Christ Church, Oxford, and Melrose Abbey, are strictly, as respects the French definition, *culs de lampe;* in English architecture they pass under their more legitimate and appropriate name.

Any attempt to describe more than the general characteristics of the carving exhibited on corbels of the richer and more floriated forms, such as appear as we proceed from the earlier to the later evidences, would be futile. The treatment is, in the main, the same as we find before noticed in capitals. In the Early English and Decorated, foliage alone, or interspersed with heads, and occasionally subjects, commonly occur; and in the Perpendicular, we have the admixture of both of these, with panelling, and the more square and arbitrary forms and ornaments of this age. Speaking of Early English and Decorated foliage in its application to the ornamentation generally of those periods,—and the observations he makes apply with equal force to the particular feature in hand,—Rickman says, "It is extremely difficult to describe in words the different characters of Early English and Decorated foliage; yet any one who attentively examines a few examples of each style, will seldom afterwards be mistaken, unless in buildings so completely Transitional as to have almost every mark of both styles." One great distinction he notices in the Early English, "is a certain unnatural character in the foliage, which is extremely stiff, when compared with the graceful and easy combinations, and the natural appearance of most of the well-executed Decorated foliage; and in no place," he adds, "can this be examined with better effect than at the cathedrals of York and Ely, both of which contain very excellent examples of each style." This unnatural character, or rather conventionalised representation of foliage, in the earlier instances, has been before remarked upon, and it is a peculiarity which appears to have been retained, notwithstanding a pre-forwardness in most other respects, in the French examples, for some time after the general reception and admission of the more natural forms here. It is necessary that this should be closely examined into and borne in mind, according as the one or the other may be the object to be studied and produced,—presuming, of course, that a given age is in likeness sought to be obtained. Dealing with the free treatment evidenced in the majority of English Decorated works of the kind, we find, as before noticed, various dispositions of the oak, the ivy, and of numerous other such-like kinds of foliage, delicately handled, and with a close regard to nature. Some of the later Decorated are peculiarly so, and exhibit, both in choice and combination, extremely beautiful evidences of the taste and power of execution of that age. In many instances human and animal heads are introduced among the foliage; the former were commonly used as corbels to the terminations of labels or hood-moulds, or the stops of string-courses, &c. Occasionally whole figures, singly, or as forming subjects, occur. Several of either kind might be mentioned. In one of the latter, given in the "Oxford Glossary," *Plate 35,* the corbel is carved to represent an oak-tree, at the foot of which a herd of

swine is feeding, while the swineherd stands at the side beating down the acorns. Indeed, almost every variety of similar representations might be found to have the authority of former usage. In the French capitals, corbels, and *culs de lampe*, sculptured subjects of this sort are almost illimitable. Some exceedingly fine examples are given in Violet le Duc's Dictionary, before referred to; and there are numerous others in French works illustrating the ecclesiastical and other buildings of that country.

In the next style, viz. the Perpendicular, there is a large introduction of foliage and carving of the same description as the last named; but it is now less distinguished as separate ornament, being generally associated with the architectural forms, as an enrichment of the hollow and other members and mouldings thereof. Rickman, speaking of this distinction between Decorated and Perpendicular ornament, says, that the former are, to this extent, like Grecian enrichments; that they "may be left out without destroying the grand design of the building; while the ornaments of the next are more often a minute division of parts of the building," the architectural lines of which enclose and make subordinate to them the ornamentation; this is particularly observable in late Perpendicular corbels and pendants, which may be considered as hanging corbels. Two figured in the "Oxford Glossary," respectively from Christ Church, Oxford (*Plate* 35), and Henry VII.'s Chapel, Westminster (*Plate* 101), shew clearly the distinction here adverted to. They are of a very usual form of corbel at this period, viz., that of a semi-octagon bracket, the body of the same panelled on each face, and surmounted by a cornice and a cresting; the under part a series of receding mouldings, terminating in a knot of foliage, the hollows being filled with foliage; in the case of the Christ Church example interspersed with heraldic device. This latter species of ornament, it is to be observed, is universal during the Perpendicular period, and angels holding shields of arms and other emblems are a common form of corbel. The Perpendicular churches of Suffolk and Norfolk are full of such, and are not alone by any means in this particular. The "Oxford Glossary," to which we have so often referred,—for which we, however, offer no apology, seeing that it must be considered as a text-book on such subjects,—gives (see *Page* 101) a very curious example of a pendant from Collumpton Church, Devon, ornamented with figures of angels and shields. A splendid angel corbel, devoid, however, of the heraldic accessory, is given in Violet le Duc, from the destroyed Hotel de la Tremoille, at Paris; unsurpassed, perhaps, by the host of others of similar description, which might be mentioned. It represents an angel, having on the right hand the figure of an infant holding a palm, and on the left—kept back by the outspread arm and hand of the principal or central figure — another small figure, having the semblance of a siren, the emblem of the sin, denominated in the Mediæval age, Luxury. It was, says the authority quoted, a representation of Innocence, or Chastity, protected by a guardian angel.

BOSSES are among the next forms which it may, perhaps, be useful to consider; these are usually understood to be projecting ornaments placed at the intersection of the ribs of roofs and ceilings. They do not appear commonly, or when employed either prominently or richly carved, till late in the Norman era. "In the succeeding styles they are used in profusion, though less abundantly in the Early English than in the Decorated and Perpendicular, and are generally elaborately carved."

The Norman boss usually bears grotesque representations similar to those which are so prevalent in the other sculpture of this age, and, like such, are not generally applicable or in accordance with the received taste of the present day. It will be unnecessary, therefore, to dilate upon them. The bosses of the next, or Early English, period " are usually sculptured with foliage characteristic of the style, among which small figures and animals are sometimes introduced, but occasionally a small circle of mouldings corresponding with those of the ribs is used in the place of a carved boss. This is very common in the French and other foreign churches. In England such are limited, for the most part, to the earlier and plainer specimens of the style. In the later and in richer buildings they are sometimes very elaborate. There are some rich ones in the chapter-house of Christ Church, Oxford, at Warmington, North Hants, and at Westminster. Decorated bosses, says the " Glossary," " usually consist of foliage, heads, animals, &c., or of foliage combined with heads and animals, and sometimes shields charged with armorial bearings are used," corresponding with the similar enrichments introduced in the capitals, corbels, &c., of the same period. Sometimes a single large human or animal head forms the boss. In others the boss is composed of one or two large leaves. Examples of both these kinds existed in the groining of the crypt and other parts of Stephen's Chapel at Westminster, and there are some of the latter kind very fine at York. In other cases, the boss is formed by smaller leaves, corresponding in number with the mitred angles of the groining, which they cover and thus hide, the points being directed towards each other, and lapping over the lower surface or mouldings of the ribs, of which there is an example from Melrose Abbey, given in *Plate* 18 of the " Oxford Glossary." This latter is, however, a late and less pleasing form and arrangement than that which previously and generally prevailed.

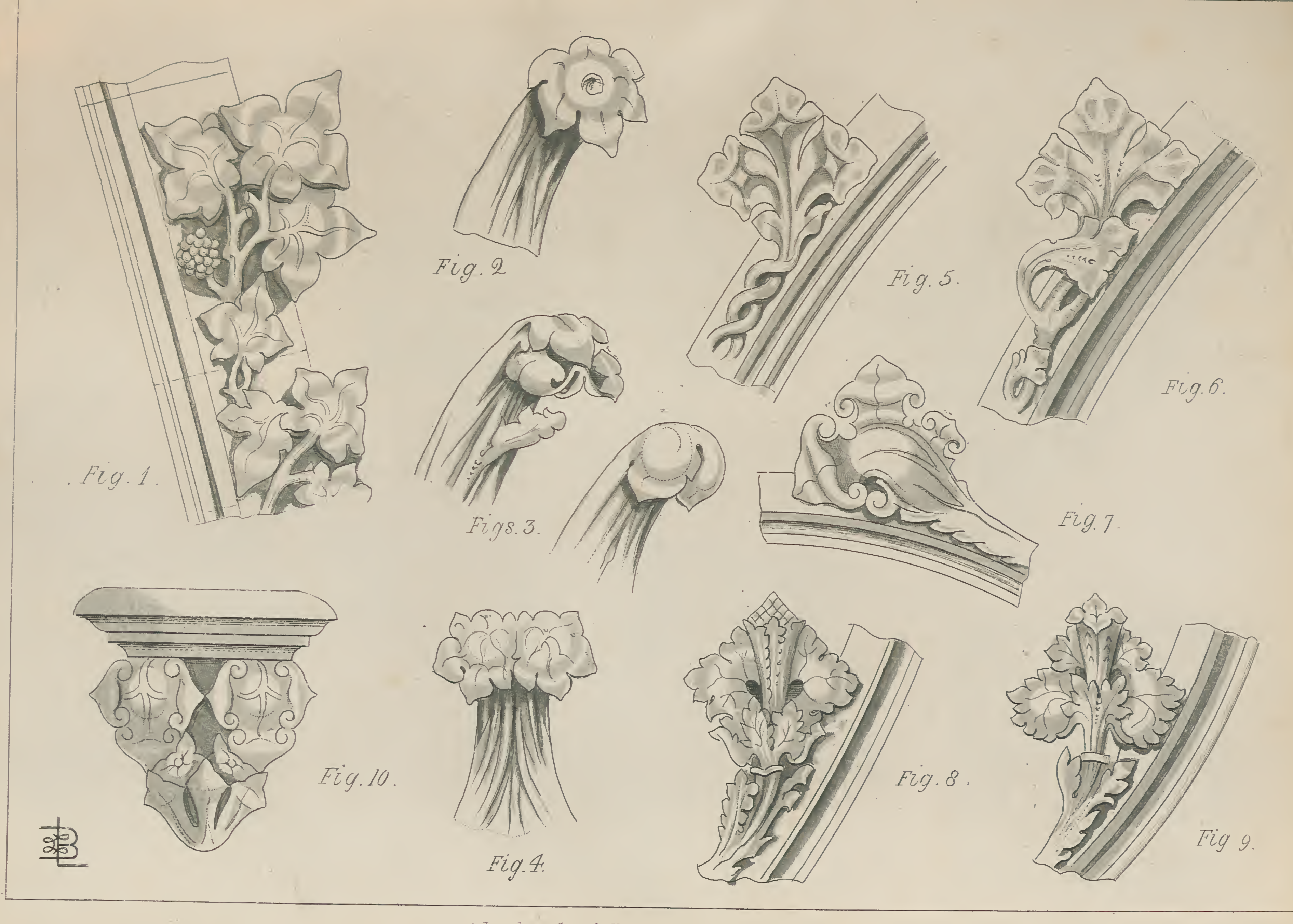
Perpendicular bosses, in a number of instances, differ but little from the Decorated, except as to delicacy of execution, and in the stiffness and more confined arrangements which distinguish the works generally of this period from the more nervous Early English and the more naturally treated and less restricted Decorated. In other respects, and with this difference, the nature of the ornamentation is much the same; there is probably a more frequent use of heraldic insignia as applied to the boss, equally with other decorative features, and also a much greater variety in the design and form of them, than in the preceding styles. The boss formed of leaves filling the angles of the ribs, similar to the Decorated ones before described, are very common, and a very usual one in wood ceilings and roofs is a flat square boss, sculptured with foliage, flowers, and other subjects, attached to the under side of the ribs. These are universal in the Late Perpendicular wooden roofs, and are often merely flat pieces of board, on which the flowers, separately and through-carved, are afterwards affixed. Late in the style, some of the bosses partake of the character of the pendants, though less pronounced, seen at Westminster, Windsor, Oxford, and elsewhere, of which they are probably, in such shape, the germs or prototypes.

Of the leaved boss filling the angles of the ribs and panels, specimens are given in *Figs.* 4 and 5, *Plate* 49, the latter from Southwold Church, Suffolk, where there are also many bosses of the flat kind just alluded to. *Figs.* 6 and 7, in the same plate, are also bosses of a similar description, the former from Lincoln, the latter from St. Alban's.

CROCKETS are other features of ornamental masonry, in which much characteristic and interesting elaboration was employed. The earlier applications occur in French architecture, and Violet le Duc traces very minutely their development. In England they are not usually found, until late in the Early English period. The varieties, both in the case of the foreign and native applications, are very numerous. In England they are most commonly used as ornaments " to decorate," says the " Glossary," " the angles of spires, canopies, pinnacles, &c. ;" they are also frequently found on gables, and on the weather-mouldings of doors and windows, and in other similar situations; occasionally they are used among vertical mouldings, as at Lincoln Cathedral, where they run up the mullions of the windows of the tower, and the sides of some of the arches, but they are not employed in horizontal situations. This former, or vertical use of them, is very prevalent on the Continent, and, as opposed to the English practice, there are instances in which they appear in the latter or horizontal position, as in Mans Cathedral. There is a very interesting example of the vertical introduction of them, somewhat similar to that which appears at Lincoln above noticed, in the tower attached to the west side of the north transept, Laon Cathedral, and an analogous one in the central tower of Coutances, though here, however, the crockets ornament the main wall and not the mouldings. Such a use, or rather abuse of crockets as this, was very prevalent, according to Violet le Duc, from 1220 to 1230 in the Isle of France. In the majority of cases elsewhere they do not appear in this way, but in their more legitimate positions.

The form and character of the earlier foreign crocketting is like most of the ornament derived from foliage at the time—very much conventionalised, and, in many cases, very simple. The Cathedral at Paris presents several very interesting evidences of this. Later they are developed in far greater richness and diversity of shape. The first form, particularly if at any elevation, usually exhibits a knop of leaves, a flower, or simple curved knop, after the fashion shewn in the one or two varieties given in *Plate* 48, *Figs.* 2, 3, 4, and as at Amiens, in the triforium of the apse, terminating the head of the issuing stem or stalk of the crocket. The Cathedral of Noyon, in common with a number of others in France which might be mentioned, supplies abundance of example of this kind. In England, something of the character of these earlier foreign specimens is more particularly to be seen at Hereford, Lincoln, Salisbury, and York, though Early English crocketting generally partakes very largely of an agreeing similarity. The Early English crocket resembling its coeval foreign neighbour, usually consists " either of small leaves, or rather long stalks, or bunches of leaves curled back," as at the east end of Lincoln Cathedral, just mentioned, and in the tomb of Archbishop Gray at York, both cited as examples in the " Oxford Glossary."

Of the succeeding and later French examples, which shew a less conventional and richer description of treatment, some very beautiful exist in the Sainte-Chapelle at Paris (1240-1245), in the Cathedral of Noyon, before mentioned, at Rheims (1257-1270), and at Strasbourg—(see *Fig.* 1, *Plate* 48). These are necessarily only a few of those, of a similar kind and age, which might be enumerated, but they will be sufficient to shew the nature and usual modes of treatment employed in the French and other foreign crockets of this period. Later, as with the Decorated style and that which succeeded it in England, more free as well as richer and more



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BOSSES, CROCKETS, &c.

Fig. 1.

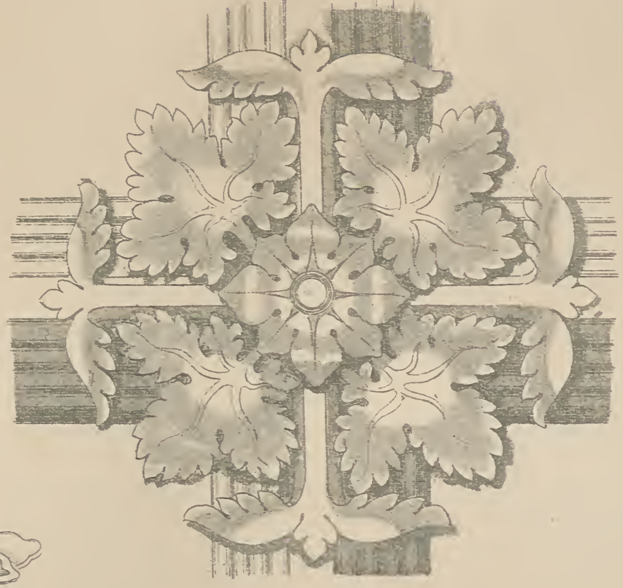


Fig. 4.

Fig. 6.

Fig. 2.

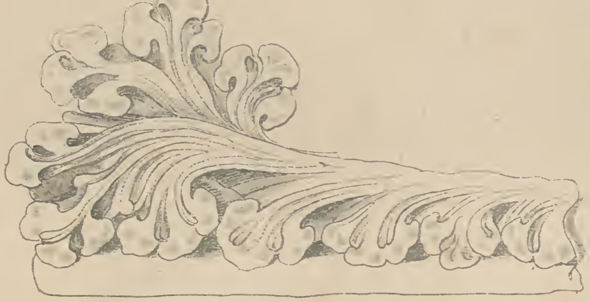


Fig. 3.

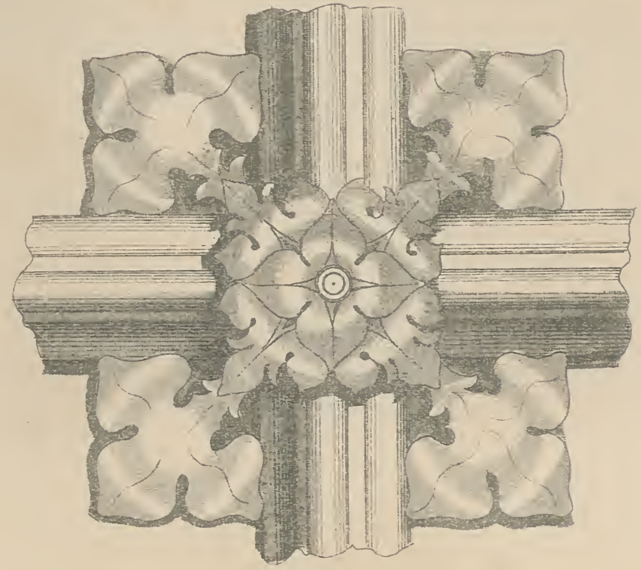


Fig. 5.

Fig. 7.

complicated forms were adopted. A very usual crocket was such as that represented in *Fig.* 1, *Plate* 49, from Milan Cathedral, and there are numerous examples of the same type to be met with in this country. *Fig.* 2, *Plate* 49, from Lichfield, is an early instance, while two given in the " Oxford Glossary," respectively from St. Mary's, Beverley, and St. Alban's Abbey, are Late Decorated and Early Perpendicular of the same class. While on English Decorated and Perpendicular crockets, it may be observed that the former are sometimes, says the authority just mentioned, " single leaves of the vine or some other tree," abroad we find adaptations of the thistle, the hollyhock, parsley, and geranium, " either set separately, as on the tomb of Walter de Merton, in Rochester Cathedral, the sedilia of Merton College Chapel, Oxford, the stalls of Chichester Cathedral, &c., or springing from a continued stalk; but the most usual form is that of a broad leaf, with the edges attached to the moulding on which it is placed, and the middle part and point raised." In the latter or the Perpendicular style, continues the same authority, " this is the most prevalent form, but they are not unfrequently made like flat square leaves, which are united with the mouldings by the stalk and one edge only." This is a very common shape in Norfolk and Suffolk, and some beautiful varieties of it are to be met with in the churches of these counties. *Figs.* 5, 6, 7, 8 and 9, *Plate* 48, are crockets of the kind here alluded to; the two first from Southwold, Suffolk; the third from Tunstead, near Norwich, in Norfolk; and the fourth and fifth from Sibton, in Suffolk. These latter examples are from the remains of a very elaborate and Late Perpendicular screen preserved in the last-named church, and are of a parallel character and treatment to that exhibited in several foreign works of the same age.

As with most Gothic detail and ornament of this kind it would be impossible to enter into description of all the variety that might be adduced, it will be enough to say that the field is very wide for observation, and the authority sufficient for the most extended application of its productions. The artist has only to supply himself with the knowledge of the proper treatment of his chosen model, according to the peculiar characteristics of the style or period intended to be represented or referred to. There is no lack of the raw material from which to select or upon which to work, and he may, if he be so disposed, and will give the requisite amount of examination and attention, soon arrive at the clear perception and ready production which so largely distinguishes the artist workman of a former age. On points of similar significance to this we have before dilated, but we offer no apology for recurring to the subject, or, as part of the lesson, directing attention, as minutely and so far in detail as we have just done, to the different matters of ornamental masonry which we have included in our observation. It is of no slight importance that all involved in the consideration of the proper source from which they are derived, and the characteristic and effective development of the ornaments chosen, should in every case be thoroughly entered into; a good building otherwise, would be spoiled by incongruous and badly designed enrichment, or by such as did not assimilate with the character and professed age, and the nature of the execution of the same. It is the peculiar attention to this which constitutes a principal charm in all the best phases of architectural art; and it must not, to ensure a pleasing result and consequent success in production, be for a moment neglected or uncared-for. With these remarks we pass to the consideration of Classic ornamentation, represented in the shape of—

CONSOLES, KEY-STONES, &c.—Consoles, or ancones, are the brackets frequently attached as supports to the projecting cornices of Classic doors and windows. In the proper signification of the term—namely, that of bracket, from the French word *console*—it also applies, and perhaps more correctly, to the supports of a balcony or other projection. The modillions of the Corinthian cornice are strictly brackets or consoles, and the term is hence used commonly by English authors for a bracket or corbel of any kind in Classic architecture.

In the general character of the Classic console there is but little variation, and the proportions deduced from the best examples are now generally admitted and followed with the modifications required by particular circumstances. The rule given by Gibbs, in which he does not materially deviate from that of the older masters, and perhaps the best modern authority of Chambers, is exhibited in *Plate* 50. In this plate, *Fig.* 1 represents the front and side view of a console, with the apportionment of its several parts and the modes of delineating or setting out the same, and which may be described as follows:—The architrave, frieze, and cornice of the door or window, as the case may be, being in height half the width of the opening, give one-sixth thereof for the former, and divide the remainder, constituting the frieze and cornice into seven parts, and of these, give four to the cornice and three to the frieze, which will answer to the depth of the upper spiral or scroll of the console. To the extended part of the scroll, F, G, forming the body of the console, give four parts, and to the lower spiral two parts. The projection of each spiral is to its height as 8 to 7,—see the divisionals, 1, 2, 3, 4, 5, 6, 7, and 1, 2, 3, 4, 5, 6, 7 and 8, against each respectively. The breadth of the console is always the same as that of the pilaster it is based upon, which should be two-thirds of that of the architrave.

The spirals are formed in the same way as the Ionic volute, having eight centres, however, instead of twelve—see the enlarged eye of the same, *Fig.* 2, where the several centres and their position are marked. As in the case of the Ionic volute, in drawing the spirals, from 1, *Fig.* 2, as a centre, describe the quadrant 1, 2; next, from 2 as a centre, the quadrant 2, 3; then, from 3, the quadrant 3, 4, and so on. The centres for the segments forming the central portions or body of the console are found as follows: viz., produce the line of the first centre 1,—forming the base of the first quadrant 1, 2, *Fig.* 1,—backwards to the pilaster at D; then with the radius D 1, describe the segment 1 F *a*; next, with a radius equal to six parts of the lower spiral, from the extremity of the same, describe the quadrant A B C, indicated in dotted lines on the figure. Then, with the radius C *a*, describe the segment *a* G, which will complete the operation. For the divisions of the front, divide the space into seven parts, and give one to each of the fillets E, E, and one to the centre bead and its listels, H, the latter being each one-fifth of a part.

In the bracket or modillion shewn in *Fig.* 3, in which A represents its profile, B its under side or soffit, and C, *Fig.* 4, its front view, the proceeding, as respects the formation or setting out of the spirals, is the same as in the preceding console. The larger is divided into eight parts in height, the space between the fourth and fifth giving the size of the eye; and for extent or breadth, into seven parts, the fourth of which gives the cathetus or centre line of the eye. The lesser spiral is four-sevenths of the greater, each of which four parts, divided into two, gives eight for the height, the breadth being seven, and the eye one, as in the former case. The centres

CONSOLES, KEY-STONES, &c.

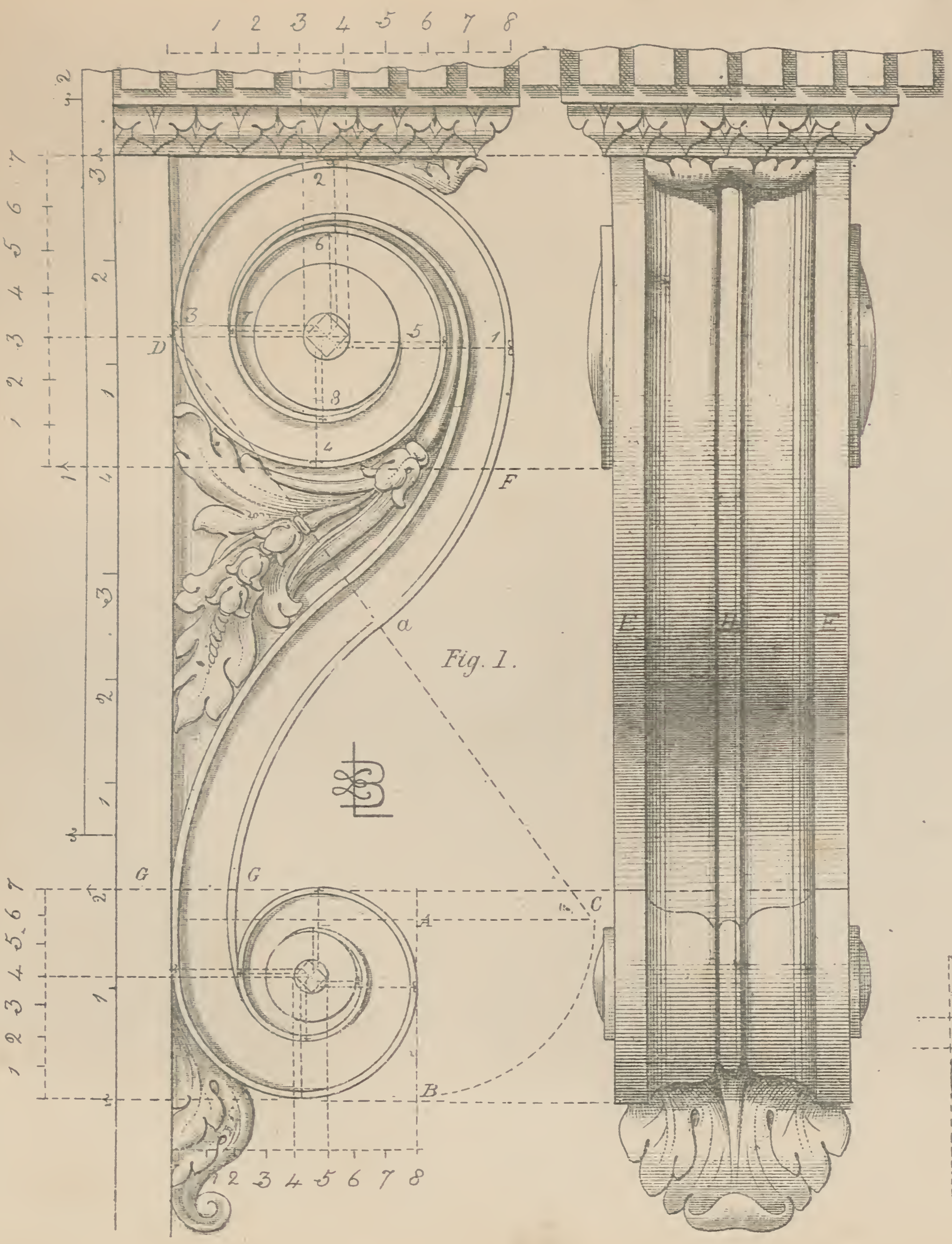


Fig. 1.

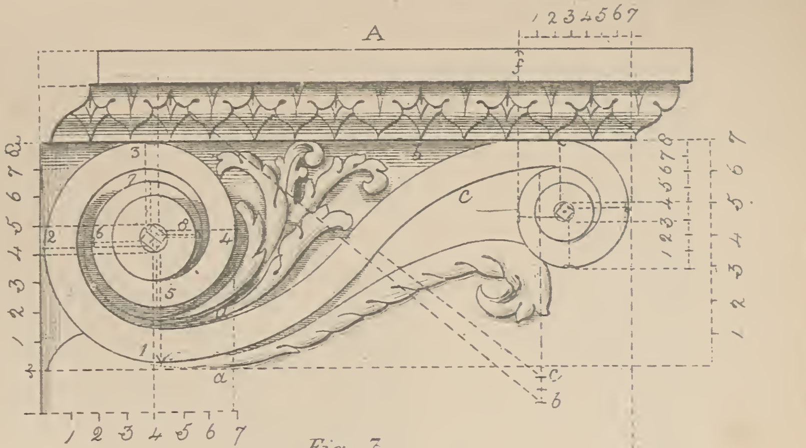
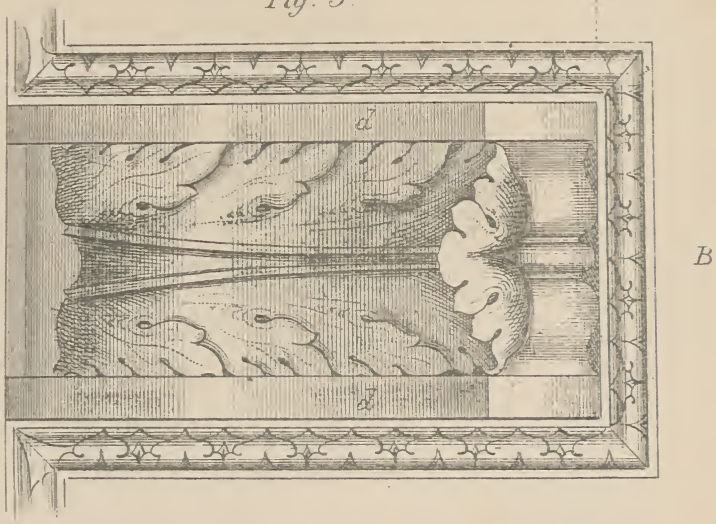


Fig. 3.



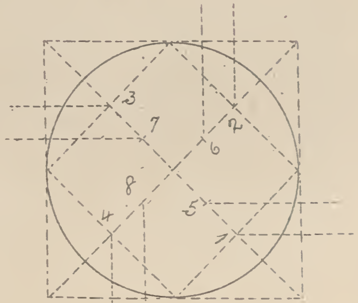


Fig. 2.

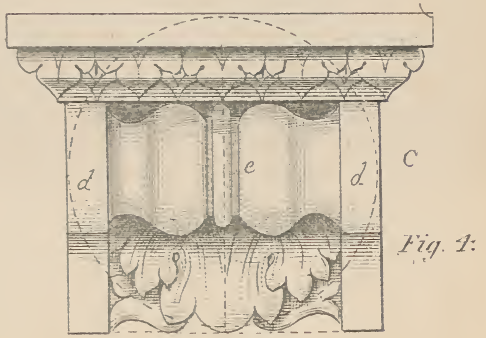


Fig. 4.

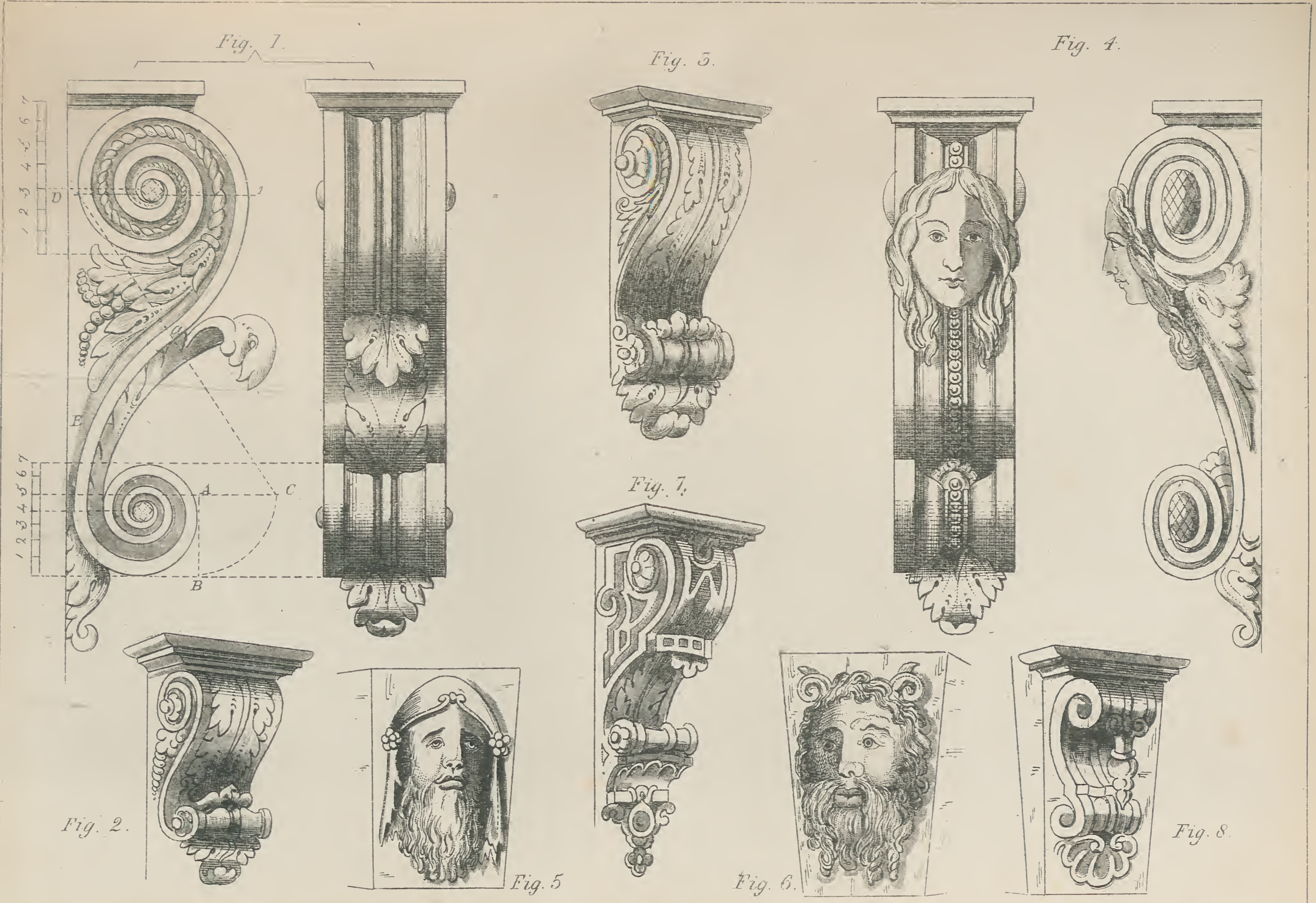


Fig. 1.
Fig. 3.
Fig. 4.
Fig. 7.
Fig. 2.
Fig. 5
Fig. 6.
Fig. 8.
A
B
C
D
E
1 2 3 4 5 6 7
1 2 3 4 5 6 7

for the segments which connect the two spirals are found as follows: that for the segments *a, a,* proceeding from the larger spiral, is on a perpendicular produced upon the first centre of the spiral, at one-fourth part of the height of the latter above it, at *f.* The centres for the segments *b, c,* proceeding from *a, a,* to the lesser spiral, are on a perpendicular let fall from the inside of the rose of the latter, and at a distance of one-fourth its height below the extreme depth or breadth, as the case may be, of the larger spiral; this one-fourth is divided into three, *b** giving the centres for the segment *b*, and *c**—the perpendicular being shortened two parts—for the centre for the segment *c*. The soffit, with the front of the bracket, B, *Fig.* 3, and C, *Fig.* 4, is to be divided into eight parts, and one given to the centre bead and its listels *e*, and one to each of the fillets, *d, d.*

Such are the usually received and accredited general proportions of the Roman console. Some variations occasionally occur in works of that age as well as of the Revival period,—see the door of San Lorenzo, in Damaso, *Plate* 11*b*; and there are differences, greater or less, among Grecian examples, as in the case of those given in *Plate* 10, shewing the doors of the Erectheum and the Temple of Hercules at Cora, but not to an extent that affects materially the principles of setting out here laid down, or the nature and mode of ornamentation here depicted, which would appear to have largely prevailed in the purer and more strictly Classic specimens, being retained also as the primary element more or less perceptible in all later work of the same kind. Till late in the Renaissance period, the spiral scroll, with its overhanging or terminating leaf, is the common decoration of the console or bracket, and, almost equally with the mask, that of the key-stone. The nature of this enrichment, and the general form in which it appears, is so well-known among workmen as to render quite unnecessary any lengthened disquisition on it, or upon the mask form of ornament just noticed as common upon the key-stone, and not unfrequently introduced, with and without a leafy adjunct, on the console proper. In *Plate* 51, we shew one or two applications of each sort, from which, with the exercise of a little care and attention, joined to a comparison of other similar objects, which may come before him, all that may be required to aid the taste of the operative in the choice and execution of like work will, we imagine, be sufficiently attainable.

Figs. 1, give the profile and front view of an enriched console of the kind shewn in a plainer form in *Plate* 50, just described.

Figs. 2 and 3, are key-stones, the decorations of which are formed from leafage in the manner before noticed as very usually observed. With the omission of the terminating leaf, the first of these would be nearly a reproduction of the under portion of *Fig.* 3, *Plate* 50, as adapted to a vertical position.

Figs. 4, shew the front and profile of a console in which the mask or human face is introduced as a feature, conjoined with other decorations.

Figs. 5 and 6, are key-stones,—as distinguished from *Figs.* 2 and 3,—of the mask description.

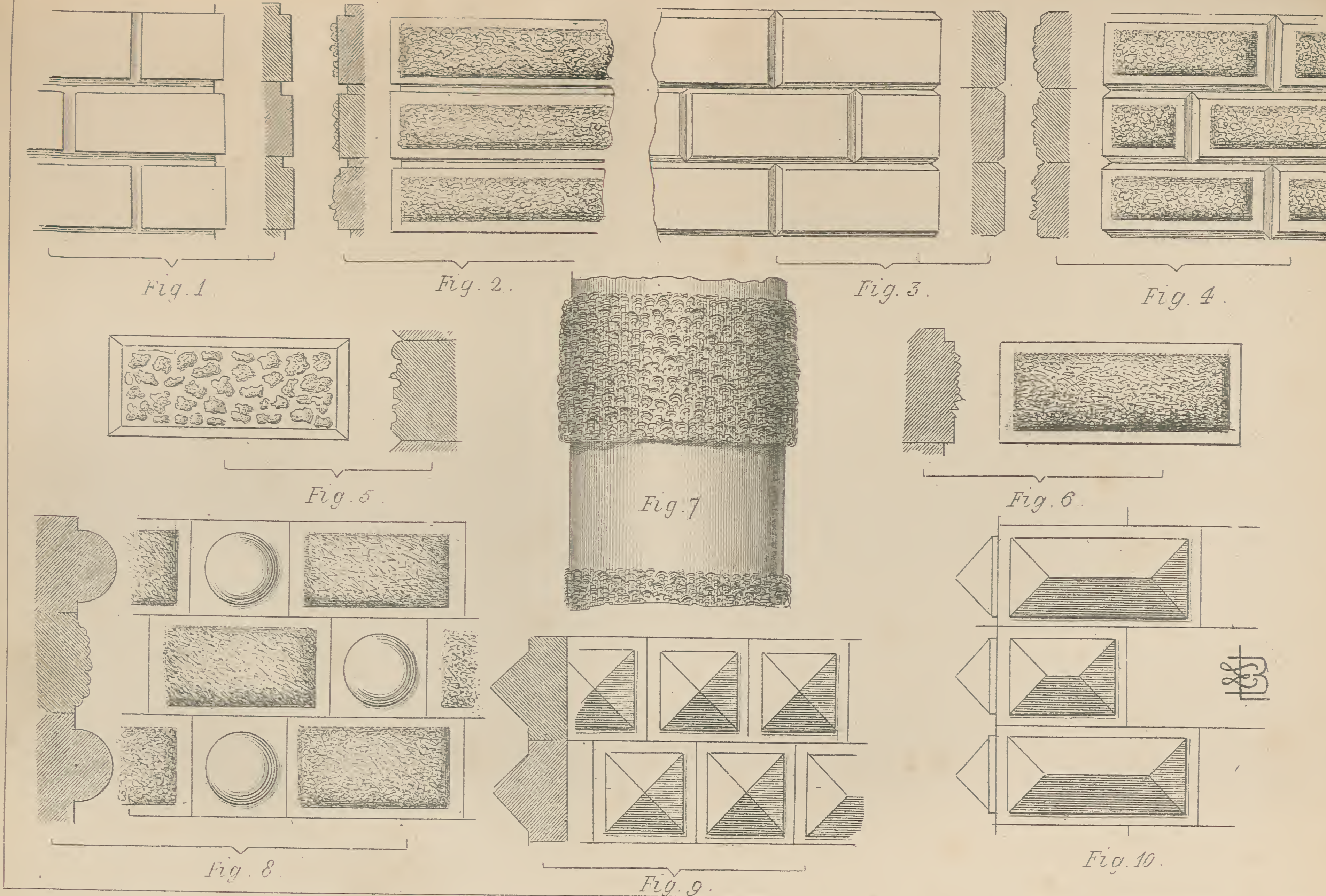
Fig. 7, is a bracket or console of the Renaissance period, and

Fig. 8, a key-stone of the same character.

Speaking of the mask key-stone, and console, it may be as well to direct attention to the generally known examples of the former in the Strand façade of Somerset House, London,

and to some of hardly less merit, as respects design, on the main arches of the building erected a few years since at the corner of Chancery Lane. These represent what may probably be considered as among the most legitimate applications and the best treatment as respects this kind of decoration. There is an appearance of simple grandeur about a well-designed and executed face used for this purpose, in the manner in these instances exhibited, very striking. In many introductions of the same kind, particularly in the Renaissance period, the result is less satisfactory, from the observance of less simple modes of dealing with the subject or idea in such cases. Many key-stones, brackets, and other accessories of a like sort, at this date, are combinations, in some cases, of whole figures, and in others of portions of such, interspersed with foliage and arbitrary forms of enrichment, in very extended prodigality—at the loss, as before observed, of the more agreeable and appropriate repose characteristic generally of the simple mask, employed as in the first cases alluded to. It is an error to give to a feature of this nature, and in this situation, with which the notion of constructive strength is, more or less in all cases, naturally and properly looked for, the apparent weakness produced by intricacy and exuberance of subdivision. The key-stone of an arch is the binding-stone, and one of a number necessary to the substantiality and proper action of the others which compose it. It has a similar amount of duty to perform, and should not by any seeming operation of ornament be made to appear less able than its fellows to perform it. This is the result unavoidably in all cases where such is exaggerated, as is too frequently the case, and care should, therefore, be taken that the decoration introduced in such positions, where it may, subject to the caution alluded to, very fittingly be, should not violate the limitation or the character necessarily involved in the consideration and due regard to the first principles of the primary construction. It is superfluous to say that decoration should be the subservient, not the opposing adjunct of the useful, and should not take from, or even appear to do so, the proper action of the latter. This is a great deal lost sight of in many of the later and more enriched key-stones, and should, it is unnecessary to say, be avoided.

ROCK AND RUSTICATED WORK is the next form in which ornamental masonry often appears—that we will now notice. The term is applied either to stones on the general surface of the wall, or at the angles only, which are left rough, or worked to a rough form, on their faces. Its origin is in the use of the material for the most part in its natural or unworked state, the ancients sometimes building with stones operated upon only on the beds and the sides where they were intended to join, the outer surface being left entirely rough. There are several forms of this rustic. A species of such, as employed by the Greeks, is found in the base of the choragic monument of Lysicrates. "But one of the noblest specimens," says Stuart ("Dictionary of Architecture") "of this kind of work, is the vast wall which surrounded the forum of Nerva, and which is now called the wall and arch of Panthanus. Other examples are found in the aqueduct of Claudius, called also the arch of Drusus, and in the amphitheatres of Pola and Verona." In modern practice Greek rustics are usually distinguished as those in which a square groove, or sinking, parallel to the horizontal and vertical lines of the joints, surrounds each stone, as exhibited in *Fig.* 1, *Plate* 52. Roman rustic-work, on the contrary, has generally, though not invariably, the angles of the stones bevilled or chamfered off from the joints, usually



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to an angle of one hundred and thirty-five degrees with the face of the stone, so that at their junction in the wall the bevil forms an internal right angle—see *Fig. 2, Plate* 52. Both the chamfered and the other kinds of rusticated stone-work have other distinctions in the nature of the work or ornamentation on the surface of the projecting part of the stone: of these—

Frosted rustic-work, as it is called, has the margins of the stones reduced or sunk to a plane of more or less width, parallel to that of the wall, the intermediate parts being worked to an irregular surface—sometimes sunk, sometimes raised, or in relief. There are very many varieties of this description of rustic-work in revived and modern Classic erections. Two are given as figures 2 and 4 in *Plate* 52. A good plain example after the Greek model exists in Vignola's gate to the Farnese Palace at Caprarola, which has been followed with modifications at Greenwich Hospital. The chamfered rustic is also effectively treated in the rustic door of the same author, in the 33rd plate of the small edition of his "Orders of Architecture," published in 1810 at Milan by the brothers Vallardi, and a number of others might be adduced.

Vermiculated rustic-work, another similar kind to the frosted, has the intermediate parts, such as mentioned in them, so worked as to have the appearance of being eaten by worms.

There is another kind, which may be perhaps aptly called the *granulated*, from the surface being worked to imitate the rough natural grain of a coarse stone. A modern specimen of this is to be seen in the building at the corner of Chancery Lane, where it has a very pleasing effect.

Another description, which may be denominated *curled* rustic-work, is exhibited on the columns, &c., of the gateways in the screen of Burlington House, in London—see *Fig.* 5.

All these several varieties are, it is to be observed, used as well on the general surface of walling, &c., particularly where indication of greater strength in basements or other sub-construction is desired, as for the purpose of quoining simply, to which latter the term of rustic quoins is usually applied. It is to be remarked, however, that though comprised in each case under the general term of rustic-work, the latter word is now generally used with reference only to such forms of the work as are simply made with the grooves between the courses, the application of *rock* being considered more properly to belong to such as shew, in addition, the various kinds of irregular face imposed upon the stones. Rock-work is, therefore, such as that exhibited in *Figs.* 2 and 4, *Plate* 50, the former of which shews the rectangular, and the latter the chamfered joint, and in *Figs.* 5 and 6, respectively of the same section; and rustic-work such as is shewn in *Figs.* 1 and 3.

Applications of rock and rustic-work, or parallel kinds to such, may be traced from the original Classic in occasional introductions through the earlier and immediately succeeding portions of the Middle age to the Revival period, when the same became in many cases very commonly admitted. Brunelleschi is noted as having employed the same in great profusion, which later architects have followed, but with less prodigality, and, as has been observed, with more taste. The mediæval examples are curious, as affording another instance of the reference to older practices still held in the changing circumstances, necessities, and tastes of later times. Violet le Duc says that it is particularly in works of fortification, towards the close of the

thirteenth century, that this kind of construction at this period appeared, and for the most part in the countries or places where the harder or more durable kinds of stone prevailed; and he gives also another, as a reason for the earlier, or more correct and general, use of the peculiarity. He says, in constructions of wrought stone, which were desired to be rapidly built, and when, in consequence, it was necessary to place the several courses without loss of time, it was customary to work only the beds, joints, and edges of the stones, leaving unfaced, or in its rough state, the surfaces between the latter. The Romans, he continues, frequently used this rapid mode of construction, and he refers for Mediæval specimens, if not built under similar circumstances of haste, at least as shewing the retention of the rusticated character, the enciente, or surrounding rampart, of the city of Carcassonne, built under Philip the Hardy; and, of the same epoch, the great tower of the archiepiscopal palace at Narbonne, with other works of the same kind at Aignes-Mortes, &c. Among the shapes the rustics of the period here referred to take, is a very curious one consisting of the introduction of a hemispherical projection, sometimes in alternate, at others in irregular order with the other stones, bearing a different form of rustication. The authority just quoted says, that these hemispherical rustics, or *bossages* as the French term them, are often found on the stone-work of fortifications erected at the time of the regular employment of artillery, and are evidently representations, it is considered, of cannon-shot. Other forms are similar to some of the ancient, and the modern examples taken therefrom. The plain parallelogramatic and rectangular rustic in imitation of the more simple Greek form occurs, less regular however, in the divisions, according to the less regular size and uniformly disposed position of the stones employed. A rustic having four surfaces bevilled to a point, very like the nail-head ornament of the Norman times, also appears. Of the hemispherical and the last form just mentioned, we give illustration taken from the authority quoted—see *Figs.* 8 and 9, *Plate* 52. A variety of the latter, which we also give in *Fig.* 10 on the same plate, is often found in later Italian work, and has been copied in still more modern times, both for quoinings as in the figure, or otherwise.

It is hardly necessary to refer, except very briefly indeed, to the applications of rustic-work during the revived Italian and more modern periods. It has been before noticed that the architects of the former made frequent use of them, with the object of giving the appearances greater solidity and grandeur. There are several instances of this in the buildings of Palladio and his succssors of the same school. A notable instance occurs in a mansion built by this architect for the Counts Thieni, at Vicenza. The front towards the street was entirely of rusticated work, excepting the attic above the main order, which ornaments the first-floor, which has the rectangular rustic; the ground-floor having the chamfered. The arcade of the interior court on the ground story is also rusticated, with the chamfered rustic enriched with rock-work.* Of the same practice, at a later date, St. Paul's, London, Greenwich Hospital, Somerset House, Burlington House, Holkham, and numerous others, exhibit almost every variety of example to greater or less extent.

* See Plates x. and xi. of Palladio's second book.

We now come to the consideration, as to some extent a phase of the last treated of, of—

SURFACE ORNAMENT.—This, as applied to Classic architecture, is a feature more usually of the later periods, at least as regards the operations of the mason. The earliest surface ornamentation of the Greeks was composed of flowers and other objects, such as the sacrificial animal head, shields and other armour, &c., in their natural or proper state. In Stuart's "Antiquities of Athens" there is a representation of a Doric frieze, supposed to have belonged to a temple of Ceres at Athens, ornamented with the heads of poppies, with a torch and a thyrsus crossing each other; and on the frieze of the Temple of Apollo, at Delphos, were suspended the golden bucklers taken from the Persians at the battle of Marathon.* These were subsequently copied in painting on the interior walls,† in the same way that mouldings and other similar features of the exterior were painted. Later, the introduction of sculptured statuary and subject was exhibited, as in the metopes, friezes, and pediments of several of the Greek temples;‡ but in the case of the less sacred erections of this people, surface decoration was commonly by painting, as in the examples at Pompeii and many of the Etruscan tombs. With the Romans, while following all these practices intact, as derived from the Greek source, floral and foliage decoration was substantialised in stone. The floral festoon or garland is in such shape a common ornament of Roman friezes, and it thus decorates the capitol, in imitation of its natural original, of the Temple of Concord. The votive wreath and the flowered thyrsus, of which an early instance has been before mentioned, are also frequent enrichments in various situations. The reference, indeed, to natural productions of this kind is almost unlimited throughout the Roman Classic period, and the applications are extended in endless variety both to the painted and the more durable stone forms. Of the nature of these in relation to either case an idea may be formed by inspection of the several figures given in *Plate* 53, which shew some of what may be taken, perhaps, as among the more common forms of design introduced as wall ornament. In their painted form, such as here shewn are of universal application throughout the Classic age, and in the Revival period have been adopted to an almost equal extent. The arabesques—as these descriptions of enrichment are usually, though incorrectly, called—of the Vatican are well-known examples of the kind. In a sculptured shape they are also very prevalent in the later Roman periods, and in that of the Italian Renaissance. Numerous instances might be referred to; they are, however, so generally known as to render this unnecessary. At a later period, when sculpture in stone could not be indulged in, a similar kind of surface ornamentation was produced in plaster. Of this the brothers Adams were the principal, if not the first, originators in this country, if we exclude the somewhat similar decorations applied to the ceilings of the Eliza-

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* Stuart's "Dictionary of Architecture," *voce* "Frieze."

† As derived from Egyptian use; for walls, painted in panels, having flowers in the centre, have been found at Thebes.

‡ Winckleman, in his "Treatise on the Architecture of the Ancients," has noticed many varieties of ornament here introduced. For similar illustration the work of P. Columbani and J. Le Vautre's "Frises et Ornaments" may be consulted with advantage.

bethan and Jacobean periods. Many specimens of the plaster enrichments so largely employed by the Adams still exist, but they are simply referred to here as shewing a kind of ornamentation derived from an original, and the more legitimate, application of stone for the purpose. It would be, perhaps, too much to expect at this day to realise old appearances and practices, as respects the introduction of surface ornament in stone, to the extent formerly applied; but there are many opportunities still afforded in which partial or limited applications might be indulged in. The faces of pilasters, both internal and external, would as readily admit of sculptured as painted ornament of this kind; interior friezes the same; and for those of their exterior, sculpture would have far superior claim in this country. For interior decoration indeed, the designs shewn in *Plate* 53 are as applicable in sculptured stone as in a painted medium, with the advantage of producing a nearer approach to the natural original, particularly if afterwards coloured as in nature, by actual relief, the appearances of which are obtained in painting only, by increased artificial means, such as shadowing, &c.

The first of these, or *Fig.* 1, is a design for surface enrichment, as applied to the end wall of an apartment having a semi-cylindrical roof. In the upper, or semi-circular portion, the wreaths or festoons and the central ornament are presumed to be sculptured in relief, (*bas* or *alto*,) upon stone, the panels between being either of coloured marble or enriched with painting. The cornice would be of stone, with carved and painted enrichments, and the frieze of plain marble. The main surface between this and the dado below is here considered as separated into compartments, the surfaces of the latter being prepared for painted or mosaic subjects, or inlaid with marbles. The wreaths here, as above, would be sculptured in *alto-relievo.* The dado, with its surbase and plinth, would be of stone and coloured marble. It will be seen that the two ideas, as relates to the painting and the inlaid marbles in the panelling, are indicated, the one on the one side and the other on the other side of the figure.

Figs. 2 and 3, are pilaster decorations of the same kind, taken and adapted from those of the Loggia of the Vatican.

Figs. 4 and 5, are designs for the surface ornamentation of a frieze or other similar horizontal face, and *Figs.* 6 and 7 are for panel and dado surfaces, shewing, as in the first and second mentioned figures, admixtures of sculpture and painting and inlay.

Following the earlier practices in this as well as in many other similar particulars, the middle age introductions of surface ornament, properly so distinguished, are very numerous. The earliest instances of it in a sculptured form take place about the Early English period. In England at this time it partakes in many instances of the admixture of geometric and flowing forms; abroad the character of the latter is perhaps more distinctly retained, the natural consequence probably of a less distant proximity to the original sources from which the practice travelled.

Fig. 8, in *Plate* 54, is a good example of an early foreign form; and *Fig.* 5, from the church of Nôtre Dame at Paris, is another of somewhat later date.

In *Fig.* 1, in the same plate, we have an Early English example of foliated enrichment from the Chapter-house at Westminster, fettered to less extent than in the majority of coevai

SURFACE ORNAMENT—GOTHIC.

Fig. 4.

Fig. 5

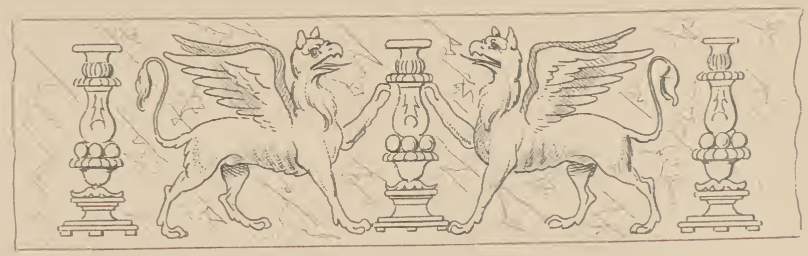
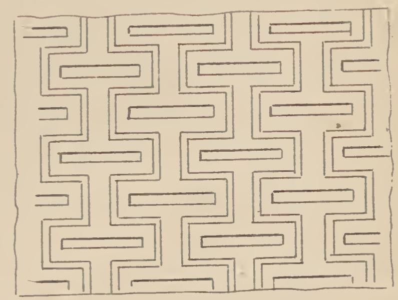


Fig. 6.



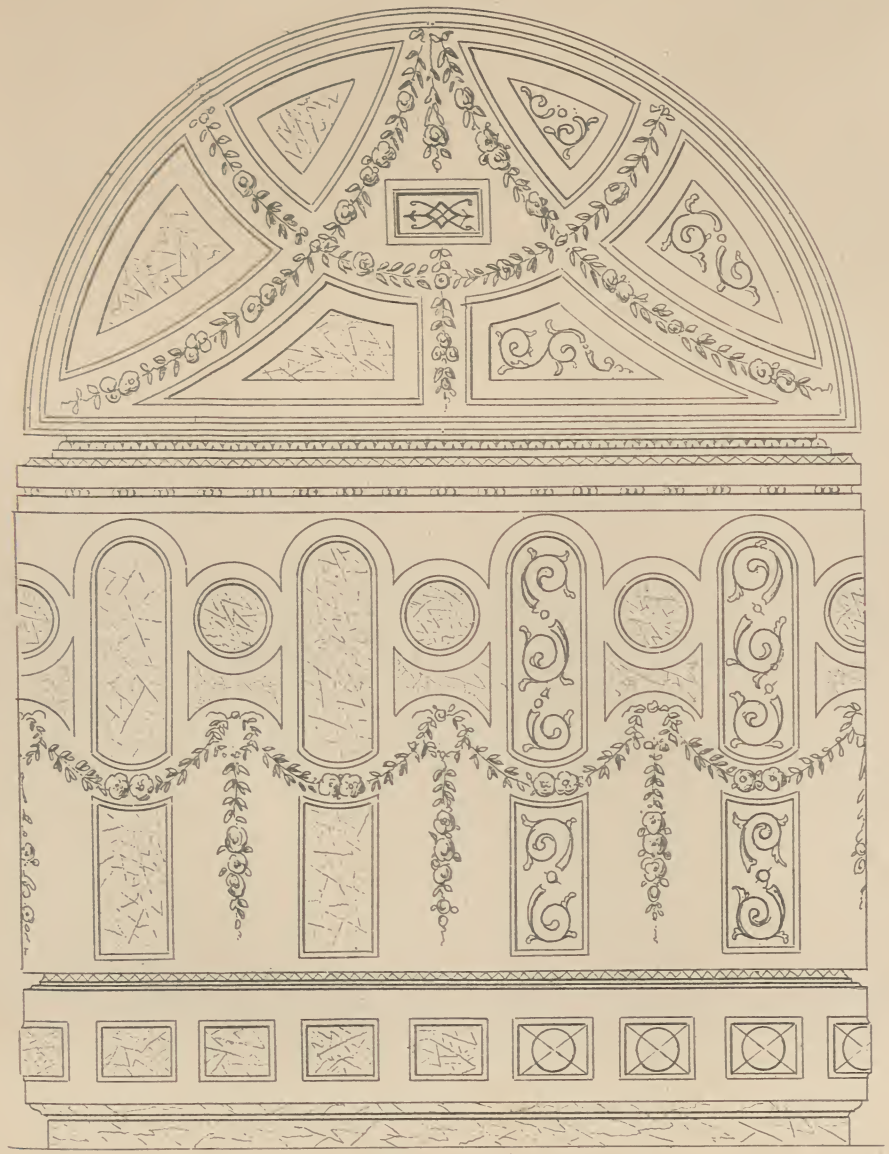


Fig. 1.

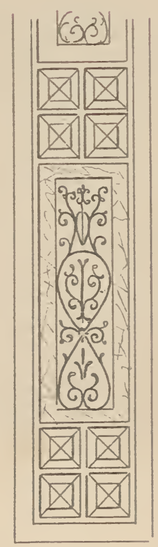


Fig. 2.

Fig. 3.

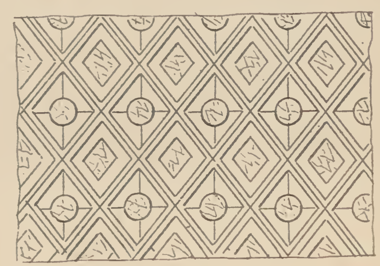


Fig. 7.

Fig. 1.

Fig. 2.

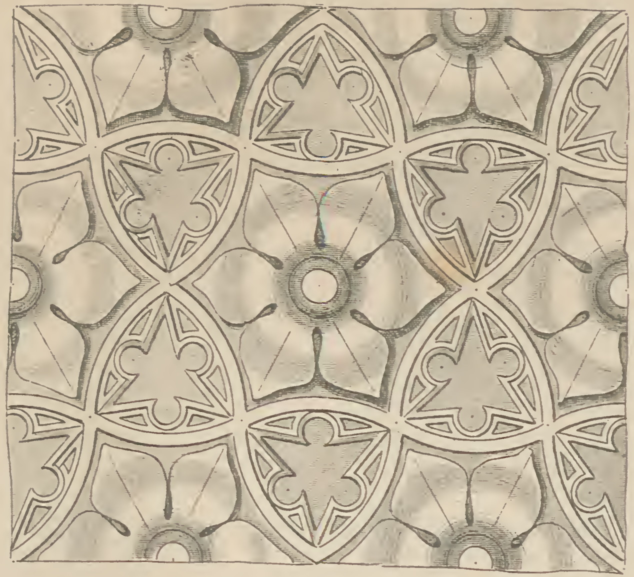
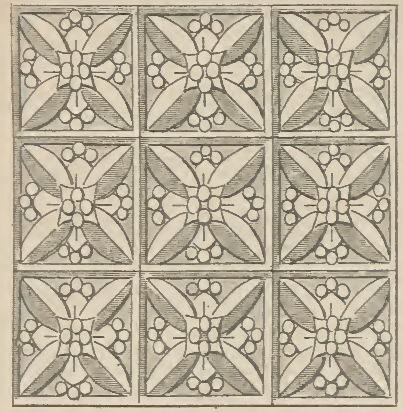


Fig. 3.



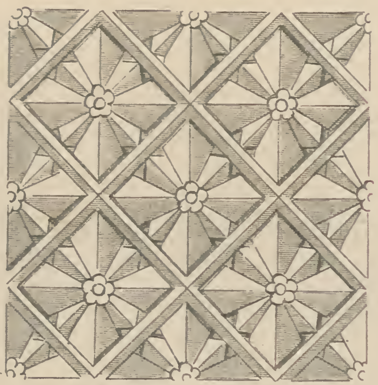


Fig. 4.

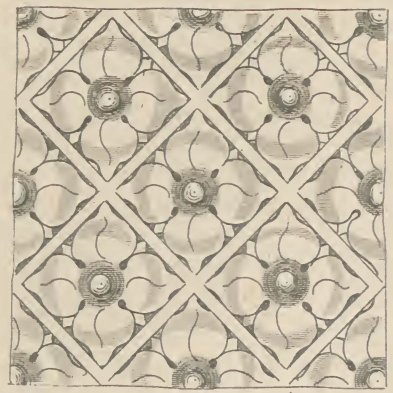


Fig. 6.

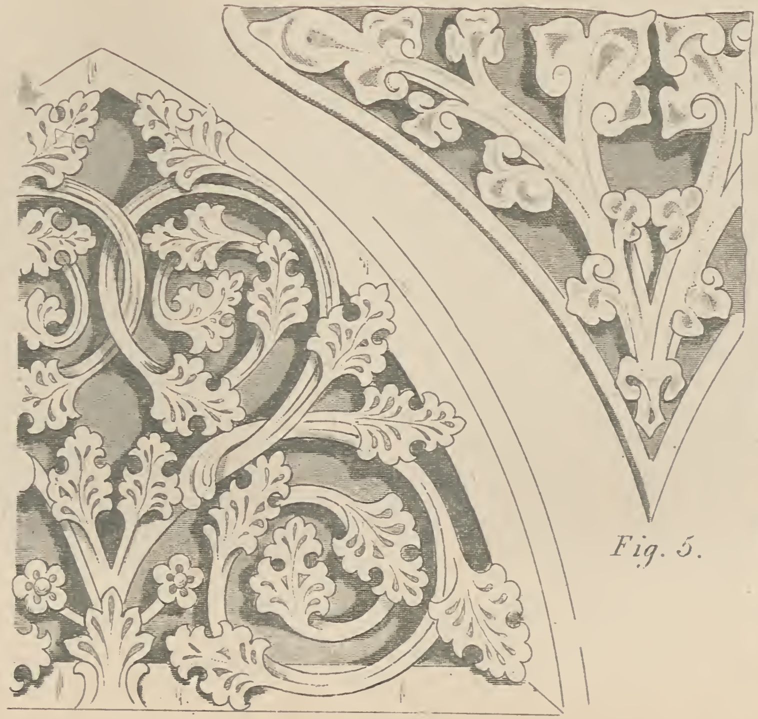


Fig. 5.

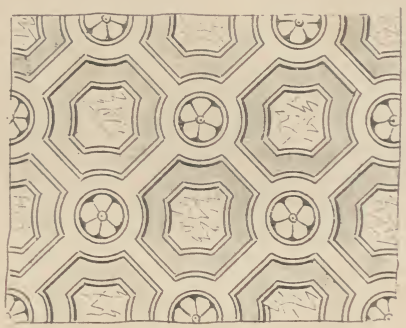


Fig. 7.

Fig. 8.

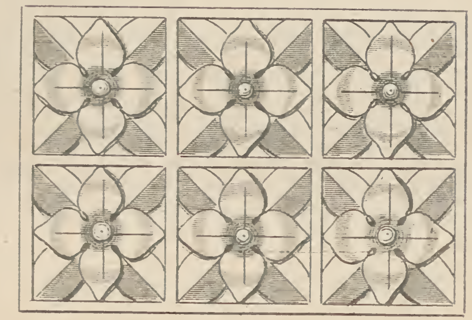


Fig. 9.

specimens with the geometric division or arrangement which characterises the examples of a similar age, shewn in *Figs.* 3, 4, and 9, respectively from Westminster, Auxerre, and Chichester. There are many instances, however, in which the surface ornament of this period is applied to the decoration of the spandrel spaces between the arches in arcades, &c., where some very beautiful arrangements of flowing foliage alone are exhibited. At Lincoln there are some rich examples, and at Stone Church, in Kent, are others; some beautiful scroll foliage also decorates the surface or tympanum beneath the main arch over the entrance to the Chapter-house from the cloisters at Westminster, and many similar instances might be mentioned.

In the Decorated period, the surface decoration resembles more nearly and generally the character and arrangement of that exhibited in the spaces between the choir arches at Westminster, which only slightly differs from that given as *Fig.* 3, in *Plate* 54. A good specimen of this—which, by the way, is distinguished during the whole of the Mediæval period by the name of diaper, the French *diapré,* from d'Ypres, a town celebrated for the manufacture of ornamented linen-cloth, (hence we have diaper as applied to towelling and table linen, &c.)—is shewn in *Fig.* 6, taken from the sedilia of Preston Church, in Kent; and there are numerous others of the same kind at Westminster, as in the tombs of Crouchback and of Valence, in that of Gervase Alard, at Winchelsea, and at Ely Cathedral and Beverley Minster,* &c. &c. At Canterbury there is also similar example in the diapers of the Chapter-house, and in addition, the very beautiful and more flowing pattern given in *Fig.* 2 in the same plate.

To all these several forms of diaper, or surface ornament, colour and gilding was very largely and frequently applied, and occasionally mosaic work of coloured glass and other composition was added to heighten the coloured effect. The specimens represented in *Figs.* 1 and 3, from the Chapter-house at Westminster, still retain their original painting and gilding; and at Canterbury and other places the glass mosaics which were added still in part remain.

This painting, which in the Early English and Decorated periods was used as a means of increasing the splendour of the carved work, was in the Perpendicular the substitute in the majority of cases for it. Perpendicular surface ornament is for the most part simply a painted decoration; a species of low relief being in some cases obtained by means of a mastic composition laid on and stamped into patterns, afterwards gilt or painted over. This was a very common mode of enriching the backgrounds of niches and the panel paintings of the later Perpendicular screens. There are some very rich examples of the former in the reredosse or altar screen of the Lady Chapel at Gloucester;† and of the latter there are numberless specimens in the churches of the eastern and some of the western counties. Of these, however, or of the painted form of surface ornamentation, it is not within our present purpose to give illustration. The former is evidently merely an imitation of the minuter descriptions of stone

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* The "Oxford Glossary" gives a small woodcut of the diaper from the Valence tomb, and in *Plate* 97 a representation of that at Beverley, which here ornaments the face of the parapet between the cornice and the coping. See the "Glossary," under *voce* "Diaper-work, Diapering."

† One of the patterns from this reredosse is given, the size of the original, in Blackburne's "Decorative Painting of the Middle Ages."

diaper, such as may be seen on the buttress faces and other smaller features in earlier architecture, in a medium applicable in the one case to the wood construction, and in the other employed as a readier and less expensive means of obtaining the same effect. There is, in the Perpendicular period, however, a species of wall decoration applied to the exterior of buildings, which it is, perhaps, necessary to notice from its great abundance in the flint counties, such as Norfolk and Suffolk. This is a species of surface decoration, which, imitating the panelled arrangements in moulded stone so general in the richer Perpendicular buildings, reproduces the same design and the same effect by more simple means. The ornamentation here alluded to is common to the Norfolk and Suffolk churches, and is obtained by a facing of cut flint, in many instances squared to great nicety of joint, laid on stone, the surface of which is sunk to the depth necessary to receive it, according to the panelled or other pattern desired to be produced. Some of the works of this kind are very pleasing; many are exceedingly elaborate, and almost every variety of panelled design is exhibited. St. Ethelbert's and the Erpingham Gate at Norwich are fine examples. There are very rich arrangements of the same kind at Southwold Church in Suffolk, where, among other patterns, an invocation to the patron saint forms an inscription, executed in this manner, around the arched head of the west window of the tower. Initial letters, similarly relieved or marked out by the juxta-position of the flint, are common enrichments of the plinths; and in many cases the imitative panelling thus formed covers almost the whole surface, as in the porch of North Walsham Church, in Norfolk, and several other instances.

With a few brief remarks on some of the other appearances of surface ornament, derived from the use of inlays and difference in the natural colour of the stone or other materials employed, we will close our observations on this feature of ornamental masonry, and on that part of our subject generally. They must necessarily be brief, for anything approaching more than a very limited view or description of the many shapes and varieties which shew themselves would extend to a volume; we shall therefore confine ourselves to a very limited and general notice of the most prevailing.

As will be seen, the kinds of surface ornament we have above faintly reviewed are the Classic and the more usual Mediæval, as exhibited more particularly in the northern Gothic of Europe. In the south, from greater facilities of obtaining the richer descriptions of stone and marble, a corresponding recourse was had to them as a means of decoration; following, in this respect, only the example and the practices of preceding workers in the same way. Mosaics and marble inlays are, therefore, as with the older Romans, a distinguishing mark of the Italian-Gothic and Renaissance eras. Italian buildings of the former period, to a large extent in many cases, exhibit the introduction of surface decoration in marble, in the shape of inlaid or superimposed slabs, of greater or less size. At Florence, the exterior of the Hospital of the Bigallo affords a very suggestive instance of the use of coloured marble and stone in this way, conjoined with other surface decoration in sculpture. At Lucca, in the Cathedral, are examples of a similar kind. The Church of St. Francis, at Assisi, is a noted storehouse of mosaic and marble enrichment; and numerous other of the Italian cities present a very extensive application of wall ornament, both internally and externally, derived from similar adoptions. As

before observed, the introduction of the marble and coloured stone is frequently in the shape of inlaid panels in the same plane as the wall, or of sunk panels enclosed by banded dispositions of a different coloured marble or stone, or of carved or sculptured bands of the latter. Of the last-mentioned kind some notion may be gathered from *Fig.* 7, *Plate* 54, where the sunken portions between the bands are presumed to be of coloured marble, inlaid in recess upon white marble, the bands being of sculptured stone. Of the nature and appearance of the decoration by super-imposed or inlaid slabs, a similar idea may be formed by reference to *Plate* 26, where we give, in *Fig.* 5, a view of one of the larger niches of the Pantheon. For fuller illustration we may direct attention to examples afforded in St. Peter's at Rome, and many other edifices of the Revived Classic period, most of which are given more or less fully in sufficiently well-known works describing the architectural antiquities of the Roman capital.

CHAPTER XXI.

ON LIGHTHOUSES.

Among the works of the mason beyond those which we have previously referred to, are others in connection with lighthouses, which it will be of advantage to take, in a general way, some notice of. Properly this should have taken place when we were dealing with other features of constructive masonry, but as associated with methods of building of a more complicated kind, and requiring to a greater degree, perhaps, particular modes of erection, may be not altogether improperly reserved for a more special and separate consideration. In works such as these, there is usually the extraneous action of the sea, either in immediate and constant, or occasional connection, to contend with; and, as in the case of bridges and other works subjected to similar trial, a peculiar and appropriate manner of dealing with the material employed is called for. This is, perhaps, more imperative in the case of the lighthouse than in any other edifice intended to withstand the weight and undermining action of water. Such erections are of necessity in situations for the most part fully exposed to the worst effects of this, while a stable height is an essential to their usefulness and purpose, and further increases the necessity of proper precautionary measures.

One of the most considerable of the English lighthouses of masonic construction is that erected on the Eddystone rock, by Mr. John Smeaton, 1757-1759, in the place of one principally of wood, consumed by fire in 1755, and which had succeeded the original one begun in 1696 by Winstanley, and destroyed in 1703. This last-mentioned was, as respects its upper part, like the one which succeeded it, constructed of timber, on a basement of stone, at first 14 feet, but afterwards increased to 24 feet, in diameter, 12 feet high on the upper side,

and 17 feet on the lower; on this were constructed the upper stories, polygonal in form; the light-room having eight sides, the lower stories twelve. The stone foundation was secured to the rock by iron dowels $3\frac{1}{2}$ inches in diameter, around which the masonry was carried up.

The second lighthouse was, as respects the lower portion, a compound of moor-stone and oak timber. As in the former case, this was attached to the rock by iron, the same being composed of layers of timber and moor-stone to the height of 33 feet, above which the structure was wholly of timber frame; the height above the circular base being 61 feet, the superior or upper diameter 14 ft. 3 in., and the lower 22 ft. 8 in.; the whole building presenting the form of the frustum of a cone.

On the destruction of this building, as before noticed, by fire, the present Eddystone Lighthouse was projected and shortly after built. Differing from its predecessors, this is wholly of stone, the lower portion being moor-stone or granite, and the rest Portland; and there is a variation also in the section of the form. The reasons which induced Smeaton to deviate in this latter particular from the previous one adopted by his predecessor, he himself gives very minutely, at the same time that he admits the desire to retain as much of Rudyard's as was consistent with the different nature of the material he had in view. He says, having reflected much, previously to making his design, on the several structures that had occupied the rock, and speaking with reference to that of Rudyard, that it appeared evident to him "that had it not been for the moor-stone courses, inlaid with the frame of the building, and acting therein like the ballast of a ship, it had long ago been overset, notwithstanding all the branches and iron-work contrived to retain it; and that in reality the violent agitation, rocking, or vibration, which the late building was subject to, must have been owing to the narrowness of the base on which it rested, and which the quantity (amount) of vibration it had been constantly subject to had rendered, in regard to its seat, in some degree rounding, like the rockers of a cradle. It seemed, therefore," he continues, "a primary point of importance to procure, if possible, an enlargement of the base; it also seemed desirable to adhere strictly to the conical form, when the necessary consequence would be, that, the diameter of every part being proportionably increased by an enlargement of the base, the action of the sea upon the building would be greater in the same proportion; but as the strength increases in proportion to the increased weight of the materials, the total absolute strength to resist the action of the sea would be greater by a proportional enlargement of every part, but would require a greater quantity of materials. On the other hand, if we could enlarge the base, and at the same time rather diminish than increase the size of the waist and upper works, as great strength and stiffness would arise from a larger base, accompanied with a less resistance to the acting power, though consisting of a less quantity of materials, as if a similar conical figure had been preserved." Upon this he acted, and gave to the erection, by enlarging the base, the form of the waist or bole of a tree. The model which he made to test the correctness of his theory having been found to answer satisfactorily, the work commenced.

The first step, the rock having been prepared for the reception of it, was the laying of the first course, which was of moor-stone or granite. In this course "were altogether four stones," the first laid weighing $2\frac{1}{4}$ tons, "in the second 13, in the third 25, in the fourth 23, in the

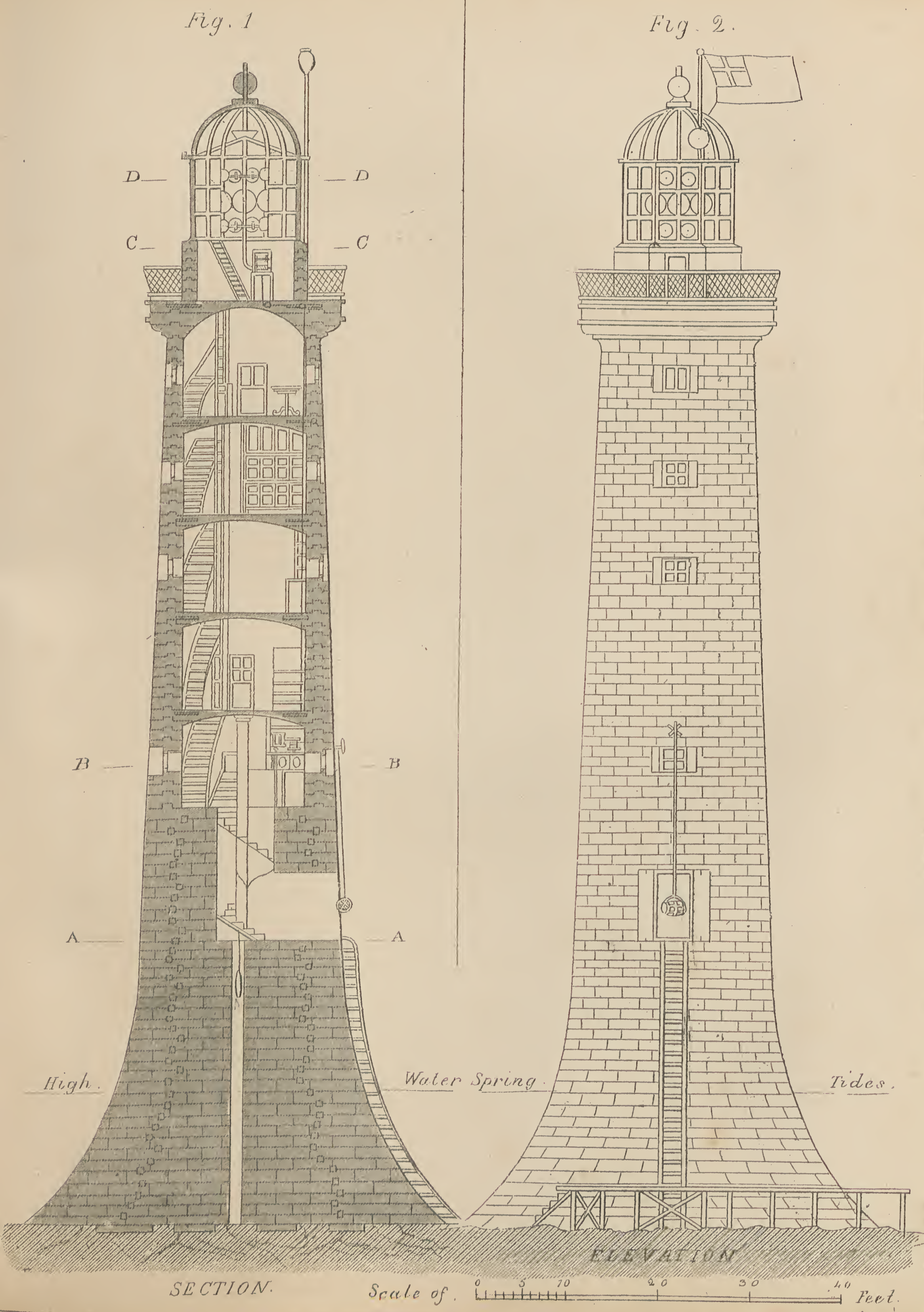
Fig. 1
Fig. 2.
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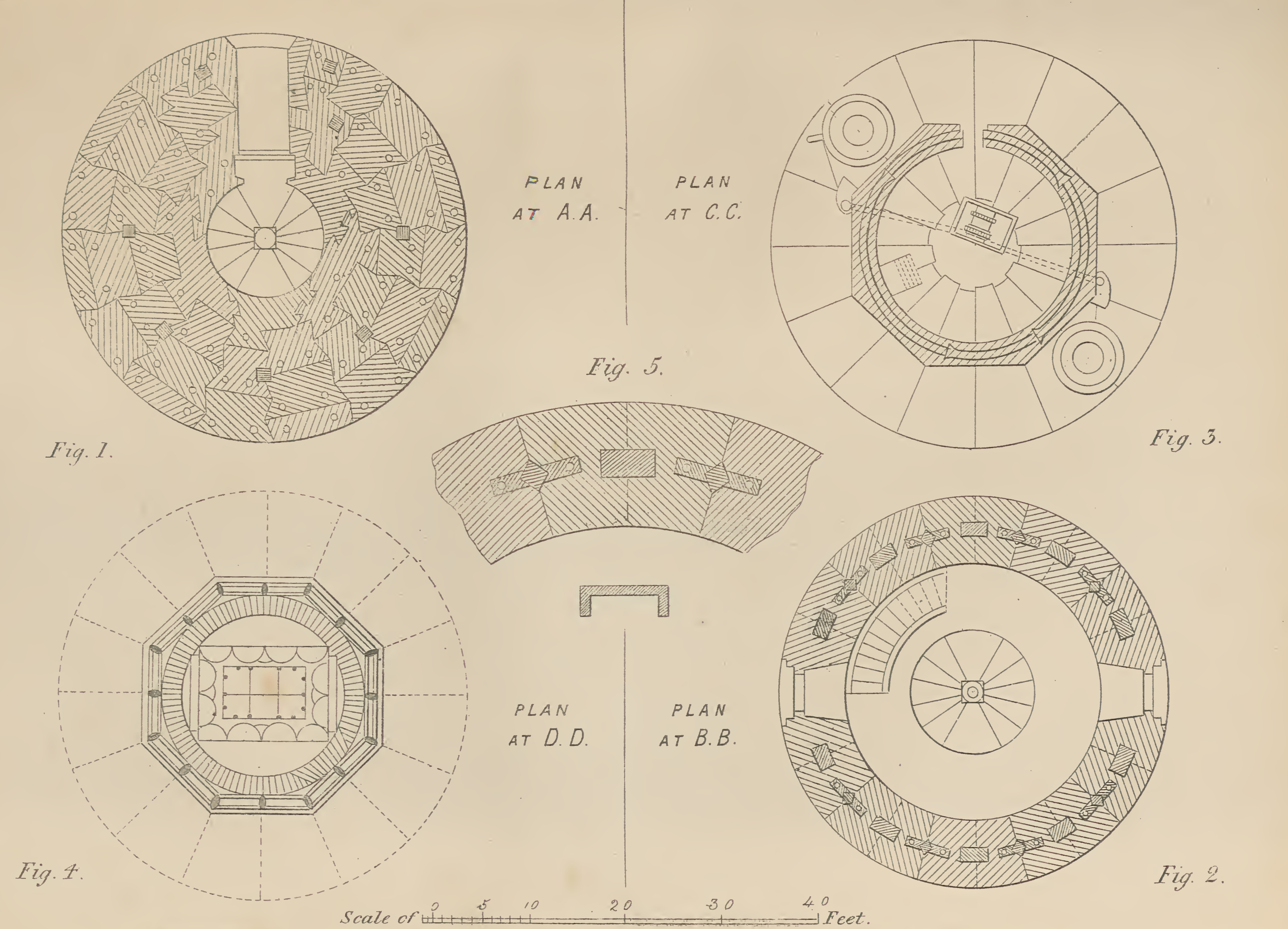

PLAN
AT A.A.
PLAN
AT C.C.
Fig. 1.
Fig. 3.
Fig. 5.
PLAN
AT D.D.
PLAN
AT B.B.
Fig. 4.
Fig. 2.
Scale of 0 5 10 20 30 40 Feet.

fifth 26, and in the sixth 26. These six courses brought the platform up level with the top of the rock." The whole were firmly cemented together with blue lias, lime, and puzzolana.

In the preparation of the stones, both of this part and the rest of the work, considerable care and ingenuity was displayed. As in the case of the Bell-rock Lighthouse, represented in *Plates* 55 and 56, and more particularly in *Plates* 57 and 58, the principle employed in the junction of them was that of dovetailing, further assisted by the insertion of oak wedges, to receive which "each stone had cut, from the bottom to the top of the course, two grooves, 3 inches in width and 1 inch in depth; the wedges themselves being somewhat less than 3 inches in breadth, 1 inch thick at the head, nearly $\frac{3}{8}$ inch at the point, and 6 inches long;" and to these were added precautions to prevent a vertical disruption, which the first-mentioned did not wholly provide against. With reference to the dovetailing and additional processes to obtain the stability here mentioned, Smeaton's observations are so instructive that no excuse will be necessary for entering into them with some degree of detail; and for this purpose we will refer to such portions of his own interesting account of his proceedings as quoted in Cresy's "Encyclopædia of Engineering," of the information contained in which we have already somewhat fully availed ourselves. Speaking in relation to this subject, and of the pains he took, says the Encyclopædia, "to consider how the blocks of stone could be bonded to the rock and to one another, so that the whole and each individual piece should form but one mass, and be proof against the violence of the sea," Smeaton goes on to say as follows: "Cramping, as generally performed, amounts to no more than a bond upon the upper surface of a course of stone, without having any direct power to hold it down, in case of its being lifted upwards by an action greater than its own weight, as might frequently be expected to happen at the Eddystone, whenever the mortar of the ground-bed it was set upon was washed out of the joint or attacked by the sea, before it had time to harden; and though upright cramps, to confine the stones down to the course below, might in some degree answer the end, yet, as this must be done to each individual stone, the quantity of iron, and the great trouble and loss of time that would necessarily attend this method, would in reality render it impracticable; for it appeared that Mr. Winstanley (the architect of the first lighthouse) had found the fixing of twelve great irons, and Mr. Rudyard (the designer of the second) twenty-five, attended with such a consumption of time (which arose in great measure from the difficulty of getting and keeping the holes dry, so as to admit of the pouring in of melted lead,) that any method which required still more in putting the work together upon the rock, would in consequence inevitably, and to a very great degree, procrastinate the completion of the building. It therefore seemed of the utmost consequence to avoid this, even by any quantity of time and moderate expense that might be necessary for its performance on shore, provided it prevented hindrance of business upon the rock; because of time upon the rock there was likely to be a greater scarcity, but on the shore a very sufficient plenty.

"This made me turn my thoughts to what could be done in the way of *dovetailing*. In speaking, however, of this as a term of art, I must observe that it had been principally applied to works of carpentry: its application in the masonry way had been but very slight and sparing; for in regard to the small pieces of stone that had been let in with a double dovetail

across the joint of larger pieces, and generally to save iron, it was a kind of work even more objectionable than cramping; for though it would not require melted lead, yet being only a superficial bond, and consisting of far more brittle materials than iron, it was not likely to answer our end at all. Somewhat more to my purpose, I had occasionally observed in many places in London, that in fixing the kerbs of the walking paths, the long pieces or stretchers were retained between two headers or bond-pieces, whose heads, being cut dovetail-wise, adapted themselves to and confined in the stretchers; which expedient, though chiefly intended to save iron and lead, nevertheless appeared to me capable of more firmness than any superficial fastening could be, as the tie was as good at the bottom as at top, which was the very thing I wanted; and therefore, if the tail of the header was made to have an adequate bond with the interior parts, the work would in itself be perfect. Something of this kind I also remember to have seen in Belidor's description of the stone floor of the great sluice at Cherbourg" (we give this idea from the "Encyclopædia," as *Fig.* 5, among the details in *Plates* 59 and 60), "where the tails of the upright headers are cut into dovetails, for their insertion into the mass of rough masonry below.

"From these beginnings I was readily led to think, that if the blocks themselves were, both inside and out, all formed into large dovetails, they might be arranged so as mutually to lock one another together, being primarily engrafted into the rock; and in the round and entire courses above the top of the rock they might all proceed from, and be locked to, one large centre stone.

"It is obvious that by this method of dovetailing, while the slope of the rock was made good by cutting the steps formed by Mr. Rudyard also into dovetails, it might be said that the foundation stones of every course were engrafted into, or rather rooted into, the rock; which would not only keep all the stones in one course together, but prevent the courses themselves, as one stone, from moving or sliding upon each other. But after losing hold of the rock by getting above it, then, though every stone in the same course would be bonded in the strongest manner with every other, and might be considered as consisting of a single stone, which would weigh a considerable number of tons, and would be further retained to the floor below by the cement; so that, when completed, the sea would have no action upon it but sideways; yet as a force, if sufficiently great, might move it, notwithstanding its weight and the small hold of the sea upon it, and break the cement before time had given it that hardness which it might be expected to acquire afterwards, I had formed more expedients than one for fixing the courses to one another, so as absolutely to prevent their shifting."

What the principal of these were we will describe in the words of the "Encyclopædia:"— The six lower courses which we have already referred to as being laid to bring the work to the level of the highest surface point of the rock, being dovetailed therein and to each other, and so being made "perfectly immovable from any force acting horizontally against them," the next or seventh course, to be constructed free of the rock, and so divested "of this natural advantage," would require to be dealt with in a manner and by means which should produce a similar effect. To provide for this "in the course number six, at the centre, a hole was cut, one foot square, and eight others, one foot square and six inches deep, were disposed at regular

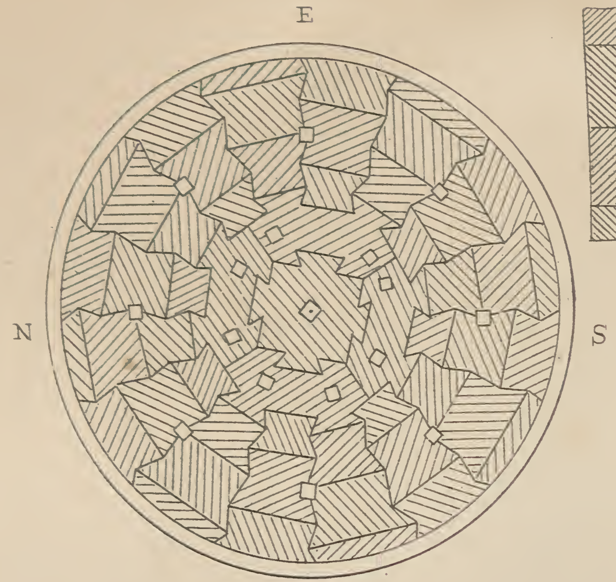


Fig. 2.

Fig. 8.

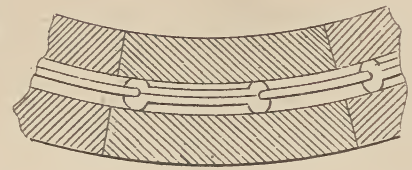


Fig. 7.

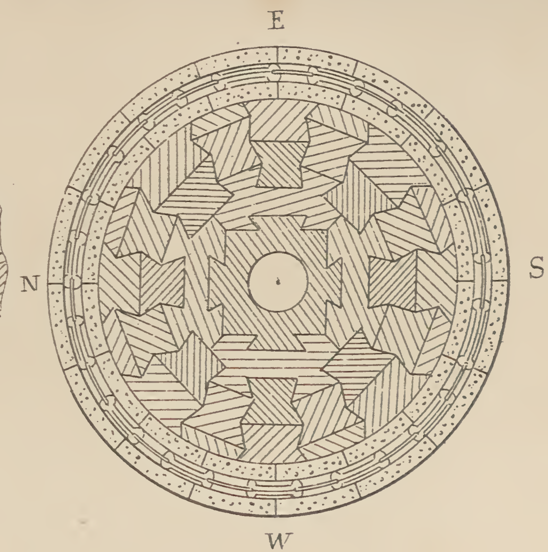


Fig. 4.

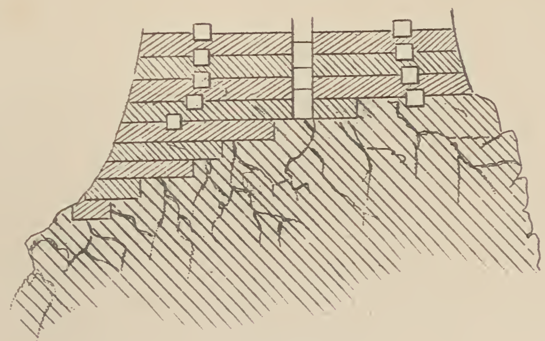


Fig. 6.

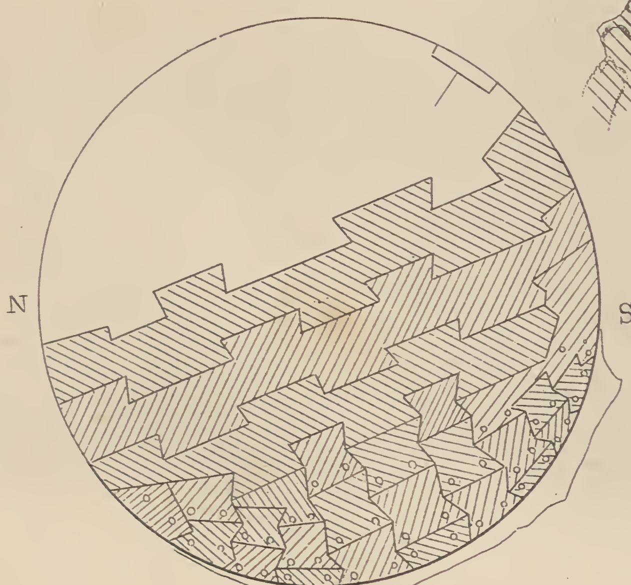


Fig. 1.

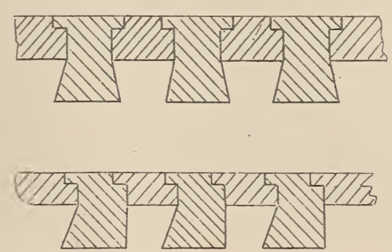


Fig. 5.

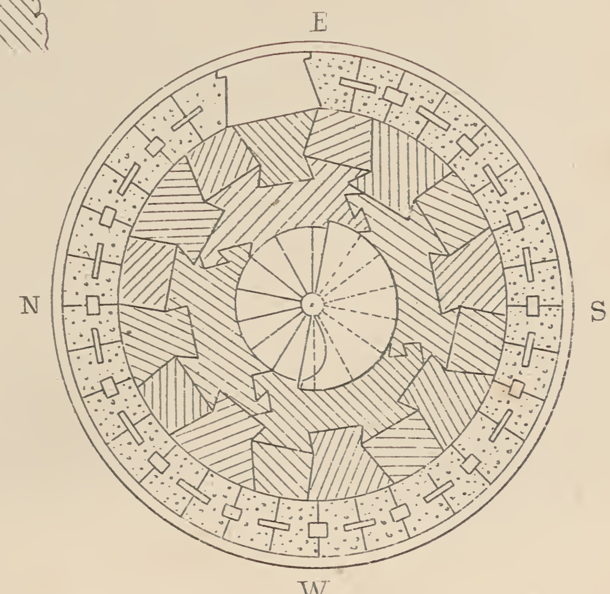


Fig. 3.

Scale of Feet.

distances round the centre; into these were introduced cubes of marble, which were to act as joggles. A plug of strong hard marble, from the Plymouth rocks, one foot square and twenty-two inches in length, was set in mortar in the central cavity, and there fixed by wedges; this plug stood up nine inches, and the centre stone of the seventh course, which had a square hole made in it, covered this plug, and, after being properly grouted, was held firmly together.

"After this centre stone was fixed, the four that surrounded it were placed, united by as many dovetails, projecting from the four sides of the centre stone; these were secured by dovetailed wedges and grouted as before, and each held down by a couple of trenails. The whole formed a circular stone, ten feet in diameter, and weighing seven tons, which was held by a centre plug and twelve trenails, the circumference of which admitted eight dovetailed recesses to be made in it, and to receive eight other stones of about 12 cwt. each; and in this manner did the work proceed until the whole of the solid part was complete. One plug in the middle, of a foot square, and each joggle of a foot cube, with the trenails, added to the strength of each course."

In *Fig.* 2, *Plates* 59 and 60, we give, for the better understanding of this description, a plan of one of the courses here described, viz., the 14th, or that at which the central well for the staircase commences, each of which it is stated were carried up in this manner,—"solid as high as there was any reason to suppose the building would be exposed to the heavy stroke of the sea; that is, thirty-five feet four inches above its base, and twenty-seven feet above the top of the rock, or common spring-tide high-water mark."

Above this height, that is to say, the 24th course, the construction of which is shewn in *Fig.* 3, *Plates* 59 and 60, the diameter is reduced, the same being here sixteen feet eight inches, while the base immediately above the rock is twenty-five feet, of which the rooms at this level occupy twelve feet four inches, and the walls the remainder.

These latter are built with "single blocks of granite or moor-stone, and sixteen were used in each course, cramped together with iron, and joggled at each joint. The joggles were made of sawn marble, 8 inches long, 4 inches broad, and 1 inch thick; each end of each block, therefore, occupies 4 inches in length, 4 inches in breadth, and $1\frac{1}{2}$ inch in the height of each joggle. To prevent any water or moisture passing through the upright joints, a groove was made in the end of each stone, into which an upright piece of stone, 6 inches broad and $2\frac{1}{2}$ inches thick, was slid into the cavity or groove prepared for it; these were mostly of Purbeck, selected for their firmness, and were run in with mortar; they also served to bond the work together. When in their places the cramps were let in, which were flat bars of iron, 13 inches in length, 2 inches broad, and $\frac{5}{8}$ inch thick, and were turned down at each end about 3 inches in length, forming a cylinder $1\frac{1}{8}$ inch in diameter." The same method was followed in the Bell-rock Lighthouse, and is shewn in *Figs.* 2 and 5, *Plates* 57 and 58. With reference to the preservation of these iron cramps from moisture, an ingenious plan was observed: "The cramps being previously fitted to the stones," each was put into a kettle of lead made red hot, where it was suffered to remain "till it had acquired the same state. About a spoonful of oil

was then poured into the cramp holes, and the cramp put into its place; the ebullition of the oil caused by the heat of the iron gave an oily surface to the whole cramp, as well as to the cavity of the stone; then the hot lead being poured in, the unctuous matter caused the metal to run into and occupy the most minute cavity, and thus defend the cramp from any action that might be produced from the salts of the sea."

The walls being thus carried up, it only remains to notice briefly the construction of the vaulted floors which formed the several stories of the building. There were four of these, the first being introduced at the twenty-eighth course, the second at the thirty-third course, the third at the thirty-ninth course, and the fourth, forming the cornice course and the substructure or foundation for the lantern and its balcony, at the forty-fifth course. At their points of introduction these floors, Smeaton observes, rest "each upon two courses," while the circumference is not "supported upon the sloping abutments of an arch, in lines tending towards the centre of the sphere, of which the underside of the floor was a portion, but upon a triple ledge carried round the two supporting courses," as per *Fig.* 8, *Plates* 59 and 60. "If each floor," he continues, "had been composed of a single stone, lying upon the horizontal bearings furnished by the ledges, it would, while it remained entire, have no lateral pressure or tendency to thrust out the sides of the encompassing walls." That "the several pieces of which the floors were composed might, therefore, have the property of a whole stone, the centre stone was made large enough to admit of a man-hole, with dovetails on its four sides, like those of the entire solid, by means of which the others were connected with it; consequently the whole, like a single stone, rested upon the ledge, without any tendency to spread the walls, which was further provided against by an iron hoop or circular chain." This chain, which was inserted at each floor, is shewn in *Fig.* 7, as is also the plan of the first vaulted floor in *Fig.* 4, *Plates* 59 and 60, and is composed of links of bar-iron, 1½ inch square, the grooves for its reception being 4 inches in depth and width, and the whole, when placed, run in with lead. In the insertion of these chains, Smeaton adopted the plan previously used by Sir Christopher Wren at St. Paul's, for the tying in of the dome, and the same was also followed in the Bell-rock Lighthouse, as will be seen on reference to *Fig.* 3, on *Plates* 57 and 58, where the same is indicated in the stone-work. This is not the only portion of the plan and constructive arrangements followed in this case. In most other particulars the methods adopted are identical, or nearly so; on a comparison of the *Plates* 55 and 56, 57 and 58, and 59 and 60, which illustrate each respectively, this will be at once observed. In the first named we give, in *Fig.* 1, a section, and in *Fig.* 2, an elevation of the Bell-rock Lighthouse, in which the same conical form and the same spread of the base is retained, the differences being mainly in the introduction of a circular newel, round which the staircase from the entrance to the first-floor winds, and within which the rope to regulate the action of the machinery of the lights descends from the lantern, having passed through the upper floors, and the addition of a fifth story in the height. As in the case of the Eddystone, the Bell-rock Light is constructed solid to a certain height upon the dovetailed and dowelled principle observed in the former; see the plan given as *Fig.* 1, *Plates* 57 and 58, being that at the terminating course of the solid work.

and marked A A on the section, *Fig.* 1, *Plates* 55 and 56, and compare the same with *Fig.* 2, *Plates* 59 and 60, which represents the similar terminating course of the solid work in the Eddystone.

Above the solid, each course of the stone-work of the walls is secured and connected somewhat differently. Instead of the joggles of marble at each bedding joint, before described as used at the Eddystone, the courses at the Bell-rock are grooved and tongued together, as seen in the section, the cramping being the same in both cases. The nature of this cramping is shewn in *Figs.* 2 and 5, *Plates* 57 and 58, the former being the plan at the level of the lower room, taken at B B on the section, and the latter a portion of the course to a larger scale.

Fig. 3, on the same plate, is a plan through the higher level C C, or that of the octagon light-room, in which the encircling chain at this point is indicated; and *Fig.* 4 is a plan taken through the lantern at D D.

As before observed, the same form, the circular on a spreading base, was adopted in both cases; in that of the Eddystone some difficulty was created by the unevenness, or sloping surface of the rock. In *Fig.* 6, *Plates* 59 and 60, it will be seen how this was met, and that the latter was graduated, or stepped, to receive the stone courses of the foundation, according to the description before given in page 228. And in *Fig.* 1, this is more fully illustrated by a plan of the third course, shewing the method previously referred to, of dovetailing to the rock.

It has been noticed that the Bell-rock Light has an additional story, and, consequently, greater height than the Eddystone; the total of the latter, excluding the lantern, being 70 feet above the rock to the floor of the light-room in the former. The corresponding point, as respects the height taken in the other case, being 97 feet 9 inches; the height of the lantern is in each case about 24 feet in addition. The respective diameters are commensurate with their difference in height. In the Eddystone, the lowest diameter immediately above the rock is 25 feet, that of the termination of the solid portion 16 feet 8 inches, and the upper diameter 15 feet. The Bell-rock Lighthouse has a lower diameter of 42 feet 8 inches, an upper of 16 feet 9 inches; that at the entrance or termination of the solid work being 22 feet.

With the above we conclude our observations on the first division of our work, namely, that of Masonry, and now proceed to the consideration of the second, or that relating to Bricklayers' Work; that is to say, of the construction and other applications of brick to building purposes, premising the same with a few remarks on the use of the material in former times, and the practices adopted in its manufacture, &c.

CHAPTER XXII.

ON BRICKS AND BRICK-WORK.

THE use of bricks is of the highest antiquity. Wherever quarries of stone were distant, timber scarce, and clay was found underfoot, this last material has been adopted. Among the most ancient races,—those dwelling in eastern climes, where great heat prevails,—it is probable that, after moulding, the bricks were originally merely sun-dried; burning, or baking, requiring some time in order to advance in the manufacture, being, however, almost invariably, ultimately adopted. Nevertheless, it is clear that the making of bricks arrived at considerable perfection at a very early period. In the Bible (2 Sam. xii. 31), "saws, harrows of iron, axes of iron, and brick-kilns," are enumerated, shewing the attainment of much complication in the manufacture, and indicating the process of baking. But burnt bricks were employed so far back as the erection of the Tower of Babel. In the region through which the Tigris and Euphrates flowed, where vast plains of alluvial soil were formed, and in which Babylon, Nineveh, and Ecbatana were built, bricks, both sun-dried and burnt, were extensively used; and lofty terraces and pyramids of this material, crumbling away, are still to be observed. The walls of Babylon were formed of bricks manufactured from the clay excavated from the surrounding trench. Some of the bricks are laid in lime-mortar of good quality; with others, unburnt clay-mortar of great thickness was adopted; while bitumen was also used. With many of the bricks chopped straw and reeds were incorporated. Various inscriptions are also observed. Babylon was rebuilt by Nebuchadnezzar; and every brick hitherto exhumed in this city, and at Birs Nimroud, bears his name. From Mr. Rich's description we may judge of the perfection attained in the art of bricklaying at the latter place: "The fine burnt bricks have inscriptions on them; and so admirable is the cement, which appears to be lime-mortar, that, though the layers are so close together, it is difficult to discern what substance is between them, and it is nearly *impossible to extract one of the bricks whole.* Other parts of the summit of the hill are occupied by immense fragments of brick-work, of no determinate figure, tumbled together, and converted into solid, vitrified masses, as if they had undergone the action of the fiercest fire, or been blown up with gunpowder, the layers of the bricks being perfectly discernible,—a curious fact, and one for which I am utterly incapable of accounting."

In Egypt both burnt and unburnt bricks were adopted alike in public monuments and domestic habitations; and they were laid in the most careful manner. In fact, there is reason to believe that bricks were used in the erection of whole cities, which, from the perishable nature of the material, have long since passed away; the more durable edifices of stone remaining, and thus inducing the idea that the latter material was alone employed, at certain periods, on

extensive works. We scarcely need remind the reader of the employment of the Israelites, during their bondage, in the manufacture of bricks. The occupation seems to have been considered of a degrading character. Clay, mixed with chopped staw, was used; and it is probable that the bricks were only dried in the sun. The straw was first provided by the Egyptians; but, after Moses interceded with Pharaoh, the Israelites had the additional labour of finding it themselves. They seem to have worked in gangs, under a superintendent of their own nation, who provided the tools and materials, and was responsible to the Egyptians. Sun-dried bricks were much used in the walls surrounding the temples, and also about the tombs; and burnt bricks for river walls, hydraulic and other works. Pococke mentions a pyramid composed of unburnt bricks, which were made of a sandy, black earth, with which pebbles and shells were mixed. It was probably sediment from the Nile; and bricks of a similar nature, from the sediment of rivers, are still manufactured in various eastern countries, as well as in Egypt. At Thebes there are arches formed of sun-dried bricks composed of clay and chopped straw. In Rosselini's work on Egypt the ancient methods of manufacturing bricks are very clearly delineated.

Wherever researches have been made, bricks are observed in ancient structures in all parts of the East. The Hindoos used them very extensively. In China, although, as at the present day, timber is chiefly employed, bricks, both burnt and dried in the sun, have been adopted from the remotest period. Many public monuments, the pagodas for instance, are erected in brick-work. The brick walls of domestic habitations, according to Chambers, are about 18 inches in thickness. He observes that the foundations are brought up for three or four courses in solid work. In the walls the bricks are laid in the alternate courses as *headers* and *stretchers* on the two faces of them, so that the headers meet and occupy the whole thickness, leaving a void between the stretchers; another course of stretchers, breaking the vertical joints, is then laid. The ancient Persians made sun-dried bricks in wooden moulds, 8 by 6 by $2\frac{1}{2}$ inches. Straw was mixed with the clay, which was tempered with the feet. The bricks were smoothed by hand, and placed in rows, one above another, for drying. With the bricks intended to be baked ashes were incorporated. In the beautiful style of the Moors brick materials were chiefly used; and, going to the Far West, we find in Mexico the celebrated Cholula pyramid, erected of unburnt bricks and clay in alternate layers.

With respect to the Greeks and Romans, it was once supposed that the former people did not use bricks till after their subjugation by the latter. There were, indeed, no large rivers in Greece to produce an alluvial soil, and stone abounded both in the mother country and its various colonies. But certain structures, mentioned by Vitruvius as built of brick, are probably of earlier date than the Roman conquest. Such are the cellæ of the temples of Jupiter and Hercules, and the wall of Athens towards Mount Hymettus and Pentelicus. The observations of the great Roman architect are replete with practical information. He first treats of the earth of which bricks ought to be made: "Gravelly, pebbly, and sandy clay are unfit for that purpose; for if made of either of these sorts of earth they are not only too ponderous, but walls built of them, when exposed to the rain, moulder away, and are soon decomposed; and the straw also, with which they are mixed, will not sufficiently bind the earth together, because of its rough

quality. They should be made of earth of a red or white chalky or a strong sandy nature. These sorts of earth are ductile and cohesive, and, not being heavy, bricks made of them are more easily handled in carrying up the work. The proper seasons for brickmaking are the spring and autumn, because they then dry more equably. Those made in the summer solstice are defective, because the heat of the sun soon imparts to their external surfaces an appearance of sufficient dryness, while the internal parts of them are in a very different state; hence, when thoroughly dry, they shrink and break those parts which first dried; and thus broken, their strength is gone. Those are best which have been made at least two years, for in a period less than that they will not dry thoroughly. When plastering is laid and set hard on bricks which are not perfectly dry, the bricks, which will naturally shrink and consequently occupy a less space than the plastering, will thus leave the latter to stand of itself. From its being extremely thin, and not capable of supporting itself, it soon breaks to pieces, and in its failure involves sometimes even that of the wall. It is not, therefore, without reason that the inhabitants of Utica allow no bricks to be used in their buildings which are not at least five years old, and also approved by a magistrate. There are three sorts of bricks: the first is that which the Greeks call *Didoron*, being the sort we (the Romans) use; that is, one foot long, and half a foot wide. The other two sorts are used in Grecian buildings; one is called *Pentadoron*, the other *Tetradoron*. By the word *doron* the Greeks meant a palm; the word signifying a gift which can be borne in the palm of the hand. That sort, therefore, which is five palms each way is called *Pentadoron;* that of four palms, *Tetradoron*. The former of these two sorts is used in public buildings, the latter in private ones. Each sort has half bricks made to suit it, so that when a wall is executed the course on one of the faces of the wall shews sides of whole bricks, the other face of half bricks; and being worked to the line on each face, the bricks on each bed bond alternately over the course below."

At Rome itself there was the clay of the Tiber at hand, and bricks, burnt and unburnt, were early manufactured; although marble, travertine, the plutonic congeries, and peperino, were preferred from their superiority in durability and appearance, notwithstanding the cost of transport in some instances. The bricks most in use, according to Pliny, were 18 inches long and 12 inches broad. Others are observed of the following dimensions: 1 ft. 10 in. square by $2\frac{3}{4}$ in. thick; $16\frac{1}{2}$ in. square by $2\frac{1}{2}$ in. thick; and $7\frac{1}{2}$ in. square by $1\frac{1}{2}$ in. thick. Some closely resemble Dutch clinkers in size and colour.

In this country remains of Roman brick-work are observable at Dover and Richborough castles, Kent, at Leicester, Wroxeter, York, Lincoln, Verulam, &c. Bloxham observes that —" Walls of Roman masonry were chiefly constructed of stone or flint, according to the part of the country in which one or the other material prevailed, embedded in mortar, with pounded brick intermixed with the lime, and bonded at certain intervals throughout with regular courses or layers of large flat bricks or tiles, which, from the inequality of thickness and size, do not appear to have been shaped in any regular mould. Of the ruined structures of Roman workmanship still existing in Britain, one of the most remarkable is the portion of a wall at Leicester, near the church of St. Nicholas, apparently the fragment of some Roman temple or basilica. This wall contains several arched recesses, the soffits or vaultings of which are turned

with courses of large flat bricks; rows of these are likewise interspersed throughout the wall at intervals, as bonding courses, and the Roman mode of constructing the arch with brick-work is here clearly displayed." (*Principles of Gothic Architecture.*)

On the continent brick-work continued to be partially used in the Romanesque and Byzantine styles; but it declined in the Gothic style until the revival of the art in the mediæval edifices in northern Italy. In England also the use of bricks was discontinued from soon after the time of the Romans until about the end of the thirteenth century, from which time it has rapidly increased.

With respect to bricks made at the present day in England, the mode of manufacture varies considerably in different parts of the country, according to the character of the materials, the quantity, kind, and form of bricks required, the means at disposal, whether by hand-labour or machinery, and other circumstances. The methods here described are, therefore, to be understood as by no means universal. When great rapidity is necessary, as, for instance, in some railway works, a very summary process is adopted.

The general proceeding is successively:—First, excavating, weathering, and preparing the earthy material; next, its careful tempering; thirdly, moulding into various forms, whether rectangles, splays, or curves; fourthly, drying the blocks; and lastly, baking or burning them.

Sound bricks ring with a metallic sound when struck together; they are of an uniform colour and shape, with straight arrises; are hard, free from cracks and flaws, and of regular equal size. Those of superior quality admit of being rubbed and cut with facility; and those intended for furnace-work bear intense heat without injury.

Good ordinary English bricks consist of a clayey loam, so composed that there is not too much clay, which has a tendency to induce shrinkage in the process of drying, or too much sand, which induces brittleness. "Loams" are light sandy clays. In "marls" there is a large proportion of lime. As a substitute for marl, chalk mixed with loam is used; and at the sea-side, sludge, or ooze, containing saline matter, is sometimes adopted. In fact, few earths are adapted for the manufacture of really sound bricks without some admixture, sand or loam being mixed with pure clay, and lime with loam. Fire-bricks and lumps require great attention to their composition; and the colour of bricks may be modified by the use of various metallic oxides and earths. All pebbles, lumps of limestone, and other extraneous matter, must be carefully removed before moulding; but crushing many otherwise unmanageable materials is often adopted.

The clay should be turned over one or two years before manufacturing it into bricks, that it may be deprived of extraneous matter, weathered, pulverised, and mellowed by exposure to the air, wet, and frost, so as to facilitate tempering. At the very least, it should be exposed for one winter. The top soil, usually containing vegetable matter, is technically called the "encallow." Removing this, or "encallowing," is usually done in the autumnal quarter of the year; and the brickmaking season begins about April. A coat of sifted common domestic ashes, called "soil," is laid over the clay in a layer about three inches in thickness; and this is turned over and mixed with clay about a foot in depth, the whole being "watered down." Fifty chaldrons of ashes to 240 cubic yards of clay, or, if much sand is incorporated

with the clay, 40 chaldrons of ashes to 220 yards of clay, will make 100,000 bricks. Generally 35 chaldrons of ashes are used in the production of 100,000 bricks. The operation of tempering, or reducing the prepared earth to a paste, is one of the most important parts of the process of brickmaking. It was formerly almost exclusively effected with great labour, by turning the clay with pronged hoes, and treading by men and oxen; but it is now much more efficiently and rapidly performed by means of what is called a "pugmill." This is a conical-shaped wooden barrel, hooped with iron, about three feet in diameter, with cross-beams attached to the bottom, an upright revolving iron shaft in the middle, with a horizontal beam at the top, so arranged as to admit of connection with the collar of the horse, which, in turning round the barrel, sets in corresponding motion the iron shaft and horizontal knives keyed at the centre. These cut and knead the clay, and ultimately force it out of a small hole formed on one side at the bottom of the tub. The clay which oozes from this hole is, as soon as ejected, cut into pieces by a labourer, with an instrument called a "cuckhold." What is not used at once is covered with sacks, to protect it from the action of the sun, that it may remain moist and fresh until required.

The next process is that of moulding the bricks into the requisite shape, which is effected by means of a box without top or bottom. The boxes should be carefully formed, and be of uniform size, so far as relates to the moulding of bricks to be used in the same structure, in order that they may bond regularly and closely. About London the bricks generally manufactured are 9 inches long, 4½ inches broad, and 2¾ inches thick, after burning. If bricks of other forms are required, they should be moulded so as to bond securely with the common bricks; as work in which the former are cut by the bricklayer into the desired shape is seldom sound. Undue settlement sometimes occurs, and occasionally lamentable accidents take place. Various materials, and different modes of putting the moulds together, are adopted. Some boxes are of wood, with plated iron edges; others are formed of sheet iron, cased with wood on the longer sides; while a third variety are made of brass. The last are, curiously enough, technically called *copper* moulds.

Moulding is executed in the following manner. The "feeder," as the moulder's assistant (generally a boy or a woman) is called, prepares the clay, cuts it roughly into about the required shape, and hands it to the moulder. The latter throws it with sufficient force to occupy the box, which has been previously dipped into water or sand. The clay is then pressed down so as to quite fill the angles; and the superfluous portion is cleared away by a wooden rule, 10 inches long by 1½ inch wide and ½ inch thick, called a "strike." A hollow sometimes on one side only of the brick—in which case it is formed by a piece of wood called a "kick," fastened on the "stock-board," or board on which the bottom of the box is laid during moulding—and sometimes on both sides, in which latter case it may be scratched on the upper part with the finger—is useful in affording a "key," or hold, to the mortar. In the next place, the moulded brick is removed by opening the mould, when it is placed either on a "flat" or "drying floor," or it is deposited on a thin piece of wood, called a "pallet board," and, so supported, several bricks are removed together on a peculiar latticed barrow (on which they are sanded) to the "hack." The hacks are long parallel lines of piled bricks, formed

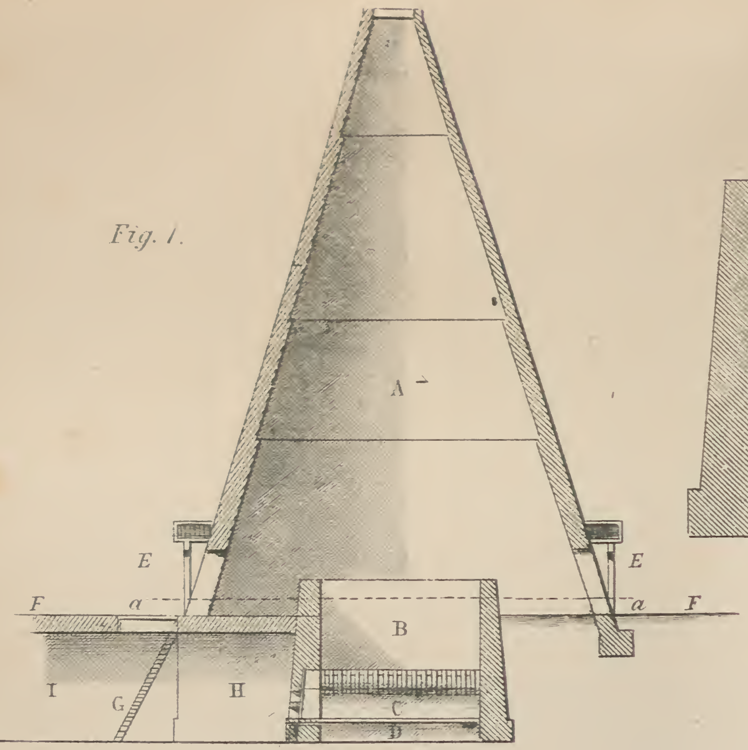


Fig. 1.

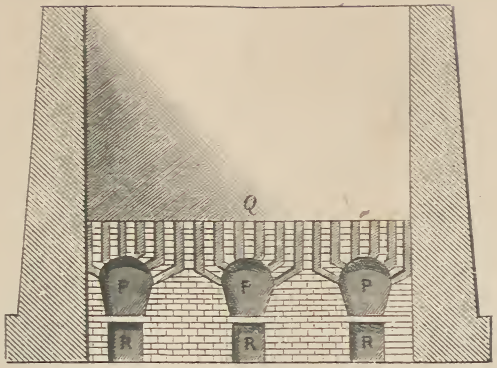


Fig. 4.

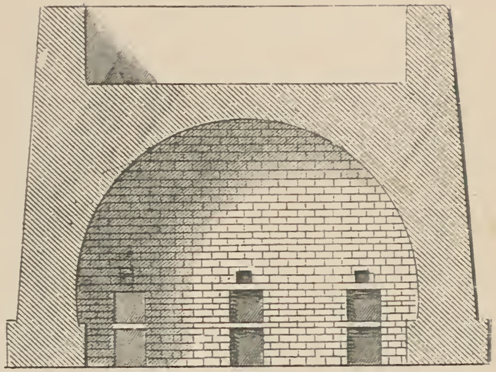


Fig. 5.

0 5 10 20 30

SCALE TO FIG.S 4 & 5.

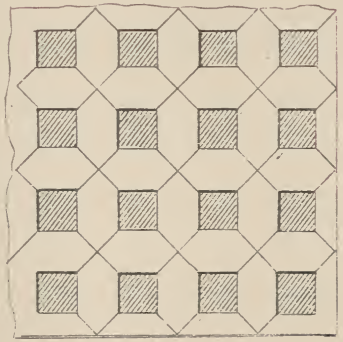


Fig. 6.

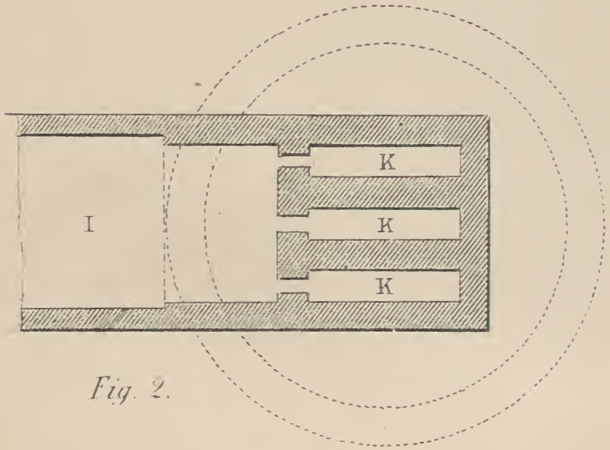


Fig. 2.

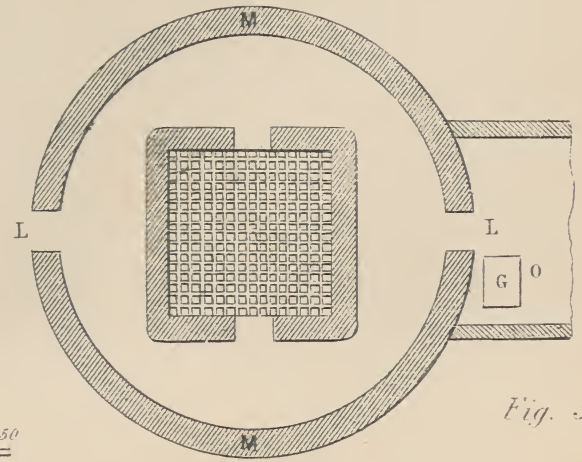


Fig. 3.

0 5 10 20 30 40 50

SCALE TO FIG.S 1. 2 & 3

11 feet from centre to centre, 2 feet 6 in. wide, and eight courses high. In the hacks the bricks are elevated a few inches above the ground, to avoid the damp; and they are arranged diagonally above one another, with ample space for the circulation of air. The bricks placed on the drying floor are sprinkled with sand, and, when slightly hardened, formed into hacks; but those which are intended to be clamp-burnt should be hacked as soon as made. It may be mentioned that a rapid workman will mould 5000 bricks in fifteen hours. There is, however, an authenticated instance of a man performing the astonishing feat of moulding 1000 bricks in a single hour; but what he did in the second hour is not recorded.

Drying the bricks requires considerable care. Drafts, exposure to intense heat, or to frost and rain, are to be particularly avoided. If the weather is showery the hacks should be covered with straw or reeds, which must be invariably employed at night. When the bricks are hacked under sheds the drying is generally retarded: their erection of course involves additional expense. The time for efficient drying depends on the state of the weather. When partially dry, the bricks are reset rather wider apart, and the lower ones placed uppermost; this operation being called "scintling." They may then be left for a week or ten days previous to burning or baking. The whole time for drying varies from three to six weeks. Warping should be corrected before the bricks are quite dry. Breaking a few taken from different parts of the hacking will indicate the dryness of the mass. Of course many bricks will appear quite dry externally, while by no means so within.

The final operation consists in burning the bricks, which is effected either in a clamp or kiln. They are usually burnt only once, but steeping them in water and re-burning is found, in many instances, to greatly improve their quality.

In clamp-burning, used for bricks in which coal-dust or ashes is incorporated, the bricks are stacked with a layer, two or three inches in thickness, composed of a mixture of cinders, ashes, and small coal, called technically "breeze," between each course of bricks, the whole being afterwards covered rather thickly with breeze. The stacks vary in size, according to the quantity of bricks to be burnt. They are usually of oblong form; and the foundation is made with any common bricks which are useless for other purposes. A fire-place about three feet high is constructed on one side of the clamp; and straight flues are run through the mass, and filled with wood, coals, and breeze. The distance apart of the flues varies from six to nine feet; and the burning generally occupies from twenty to thirty days,—the weather, besides the fire and the closeness of the flues, affecting the process.

Kilns are structures in which the bricks are stacked so as to allow of the passage of the heat from fires lighted under the floor in arched furnaces with holes at the top, or from fire-holes in the side walls. They are constructed of various forms in different country districts. Some are square, and some are circular, and domed over. About 13 feet in length, 10 feet 6 in. in width, and 12 feet in height, are ordinary dimensions. A kiln of this size will hold nearly 20,000 bricks. The walls are of pyramidal form, and one brick and a half in thickness. A plan and sections, with the various details of the construction usual in kilns of this description, are given in *Plates* 61 and 62, where—

Fig. 1, represents a longitudinal section through the entire building, in which—

A. shews the cone of the structure;
B. a corresponding section of the kiln or furnace portion;
C. the fire-place;
D. the ash-pit beneath;
E.E. the entrances;
F.F. the surface of the ground;
G. a ladder or steps leading down to the fire-place and coal-depository, the trap to which is shewn at O, *Fig.* 3;
H. a vaulted space before the doors of the fire-place; and
I. the coal depôt, or place for coals.

Fig. 2, shews the plan of the under part of the furnace or kiln, &c., B. in the former figure,
K.K.K. therein being the arched fire-places seen in cross section as P.P.P. in *Fig.* 4.

Fig. 3, is the general plan at the higher level, marked *a a*, on the sections, in which
L.L. shews the entrances;
M. the wall of the kiln;
N. the paved floor of the latter, on which the tiles, &c. are laid to burn; and
O. the trap, or way down to the fire-places below.

Fig. 4, a transverse section through the kiln, shewing
P.P.P. the fire-places and flues to
Q. the tiled floor; with
R.R.R. the ash-pits below.

Fig. 5, is a sectional cut through the vaulted space in front of the kiln, giving the elevation of such part of the latter; and

Fig. 6, is a portion of the tile floor marked N in *Fig.* 3, to an enlarged scale, shewing the jointing and shape of the bricks which form the same.

Before burning the bricks the top of the kiln is covered with pieces of tiles, turf, &c.; and wood is put in and burnt with a gentle fire to complete the drying of the bricks, this fire being kept up for two or three days. When the smoke turns from a dark to a transparent colour the bricks are ready for burning. The mouth (or mouths) of the kiln is then stopped by a "shinlog," formed of pieces of brick piled together and plastered with damp brick-earth; leaving, however, sufficient space to introduce faggots composed of heath, furze, brake fern, &c. The fire is then lighted, and supplied with fresh material until the arches turn white and flames appear darting through the top of the kiln. Then the fire is slackened for an hour, and the kiln cooled gradually. This process of heating and cooling is repeated until the bricks are quite burnt, which is usually the case in forty-eight hours.

It is observable that in clamps, the ashes being mixed with the bricks, the firing is in them, and they are burnt; but in kilns, as no ashes are mixed with the bricks, and the fire is external, the process is rather one of baking. Baked bricks are formed of what is called "refractory" clay, which has no alkaline matter or lime; while burnt bricks are formed of fusible earth.

As before indicated, the process of brick-making is varied in nearly all its stages. In some railway works, and in other cases in which time cannot be allowed for the usual methods, the clay and ashes are crushed under rollers without previous exposure and tempering, the bricks being moulded immediately, are placed in drying houses artificially heated, and then burnt. Mr. Lee's patent (now expired) for producing a good substitute for malms, which, however, is of inferior colour, is thus described:—

"A circular recess is built, about four feet high, and from ten to twelve feet in diameter, paved at the bottom, with a horse-wheel placed in its centre, from which a beam extends to the outside for the horse to turn it by. The earth is then raised to a level with the top of the recess, on which a platform is raised for the horse to walk upon. This mill is always placed as near a well or spring as possible, and a pump is set up to supply it with water. A harrow, made to fit the interior of the recess, thick set with long iron teeth, and well loaded, is chained to the beam of the wheel, to which the horse is harnessed. Previously to putting the machine in motion, the soil, as prepared in the heap in the ordinary manner, is brought in barrows, and distributed regularly round the recess, with the addition of a sufficient quantity of water; the horse then moves on and drags the harrow, which forces its way into the soil, admits the water into it, and by tearing and separating its particles, not only mixes the ingredients, but also affords an opportunity for stones and other heavy substances to fall to the bottom. Fresh soil and water continue to be added till the recess is full. On one side of the recess, and as near to it as possible, a hollow square is prepared, about eighteen inches to two feet deep. The soil being sufficiently harrowed and purified, and reduced to a kind of liquid paste, is ladled out of the recess, and, by means of wooden troughs, conveyed into this square pit; care being taken to leave the sediment behind, which is afterwards to be cleared out and thrown on the sides of the recess. The fluid soil diffuses itself over the hollow square or pit, where it settles of an equal thickness, and remains till wanted for use; the superfluous water being either evaporated by exposure to the atmosphere or drained away. When one of these square pits is full, another is made by its side, and so on progressively, till as much soil is prepared as is likely to be wanted for the season."

Numerous patents for novel systems of preparing the clay, and also moulding the bricks by means of machinery, have been taken out; but, within our limits, it is impossible to enumerate them. They involve different processes of preparing, tempering, rolling, grinding, kneading the clay, &c., producing more or less consistency, and affecting the time for drying; moulding the bricks in various forms, and with more or less rapidity (machines effecting this operation at the rate of 2000, and upwards, per hour); burning or baking; and ultimately transporting the bricks to a greater or less distance to the depository. Prosser's system of manufacturing bricks, tiles, and other earthenware articles, from dry powdered clay, which admits of immediate burning, as no drying is necessary, is very valuable, especially in the case of ornamental work, moulded bricks, tiles, &c. Machine-made hollow bricks, although generally expensive, are advantageous in preventing the passage of damp, and also that of heat, aiding ventilation, and being, in some degree, a security against fire. They secure more warmth in winter, and more coolness in summer, than solid bricks; the

passage of sound is retarded; and there are often advantages in point of cleanliness, burning, and dryness.

Usually, bricks made by machinery are harder, more compact, smoother, and heavier, than those produced by hand labour. But their weight increases the cost of removal and laying; their smoothness lessens the key, or hold, of the mortar; and their often extreme density, arising from the pressure which is employed, tends to hinder internal dryness. In small brick-works too, machine moulding, effected so cheaply by hand labour, is not found to be peculiarly economical; but in extensive works, or when a vast number of bricks are required in a limited time, there can be no doubt of the advantage, in point of cheapness, of the employment of machinery.

The expense of manufacturing bricks in different parts of the country varies so considerably, that it would be only misleading the reader to give a single list of the cost of the various kinds; and, again, the prices of one month are often by no means those of another. Whether or not the bricks are machine-made, and the number ordered, will, of course, affect the expense. Gwilt states the cost of manufacturing one thousand bricks in the neighbourhood of London as follows:—

	£	s.	d.
Digging, wheeling, carting, &c.	0	1	6
Moulding, stacking, &c.	0	11	6
Sand (one-sixth of 2*s.*)	0	0	4
Straw for hacks	0	0	9
Barrows, moulds, planks, &c.	0	0	6
Fuel, 9 cwt. per 1000	0	10	6
	£1	5	1

A cubic foot of brick-work weighs from 100 to about 150 pounds: 120 pounds per cubic foot may be taken as the average. To crush a solid mass of sound brick-work, one foot square, a weight of 300,000 pounds will usually be required. The weight of a rod of brick-work averages 15 tons.

The number of bricks consumed annually in the United Kingdom is immense, and must astonish those who are not practically versed in the subject. There are nearly 6000 brick-makers in Great Britain, exclusive of Ireland, the vast majority being located in England. About eight or nine hundred millions are supposed to be used yearly in railway works. Some idea of the total quantity manufactured may be formed from the returns published in the Government statistical tables of the annual amount of duties formerly paid.

The duty on bricks was first imposed in the reign of George III., in 1784, at the rate of 2*s.* 6*d.* per thousand. In 1794 the impost was raised to 4*s.* per thousand; in 1802 to 5*s.*; and in 1835 a further sum of 10*d.* was added to the tax. In the Act of 1802 the charges are thus stated, Ireland being exempted from the duty:—

	s.	d.
For every thousand bricks which shall be made in Great Britain, not exceeding any of the following dimensions, that is to say, ten inches long, three inches thick, and five inches wide	5	0

	s.	d.
For every thousand bricks which shall be made in Great Britain exceeding any of the foregoing dimensions	10	0
For every thousand bricks which shall be made in Great Britain, and which shall be smoothed or polished on one or more side or sides, the same not exceeding the superficial dimensions of ten inches long and five inches wide	12	0
For every hundred of such last mentioned bricks exceeding the aforesaid superficial dimensions	2	5

The said duties on bricks to be paid by the maker or makers thereof respectively.

From 1820 to 1831, the least number of bricks taxed in one year, namely 1821, was 978,655,642. In 1825 the greatest number were charged, namely 1,991,405,278. The returns for the three following years will indicate the amount of revenue derived from the impost:—

	Quantities Charged.	Amount of Duty.
1832	998,346,362	£294,332 18 10
1833	1,035,915,662	304,942 1 11
1834	1,180,161,228	347,305 5 2½

The return rose to £402,842 6*s.* 3½*d.* in 1835.

In 1839 the above duties were repealed, and in their stead an impost of 5*s.* 10*d.* per thousand was imposed on all bricks not above 150 inches in cubical contents.

The repeal of the old duties, and the abolition of the stringent regulations with respect to shape and size, are full of benefit to the public, and have induced a great change in the trade, from the reduction of the price of moulded and ornamental bricks: and this will bring us presently to the consideration of one of the most interesting features of the bricklayer's art; previously to which, however, we must take notice of a few matters of a more strictly fundamental and preliminary nature, necessary to be entered into as referring more particularly to the practical application of bricks in foundations, walls, arches, and other similar work, illustration of which has been given in the plates; and—

First, with respect to the principal tools of the bricklayer. The *shovel*, *pickaxe*, and *crowbar* are used in excavating ground and removing old work, and the *rammer* for trying the ground and also compressing it. The *banker* is a bench or table, six to twelve feet long, upon which the bricks are cut. The *trowel* is used to lay the mortar and cement; the *axe* for *axing* the bricks, or shaping them into any required bevel; the *tin saw* for incising the soffit lines of bricks to be afterwards cut with the axe; the *chopping block* on which to axe the bricks; the *rubbing stone* to rub the bricks smooth; and the *float stone* for rubbing curved work. The *jointer* and the *jointing rule* are employed for running or marking the centres of the mortar joints. The *camber slip* is a thin piece of wood with one curved edge for the lower part of the arch, and sometimes with the other edge less curved for the upper part of the arch; which last, however, is often straight. The *bevel* is used for drawing the soffit line on the face of the bricks; the *templet* takes the length of the stretcher and the width of the header; and the *mould* is for forming the face and back of the brick. The *raker* is for raking out mortar for the purpose of pointing; the *hammer* is for cutting holes and chases in brick-work: and the *hod* is for carrying the mortar.

For setting out work are used—the *plumb rule*, with a line and plummet, and the *level*, a horizontal rule with another vertical, having a line and plummet. The *square* is adopted for setting out right angles, and *templets* and *battering rules* for circular and battering work: the courses are guided by lines and pins; and when brick and stone-work are carried up together the *gauge rod* marks the height of the courses. Dimensions are taken by means of measuring rods, 5, 10, and 20 feet long, and also by tapes.

In the construction of the bricklayer's scaffold, *standards*, *ledgers*, and *putlogs* are introduced. The standards, or uprights, are tapering poles, usually of fir, forty or fifty feet in length, and six or seven inches in diameter at the lower ends, which are let into the ground. Increased height, when necessary, is obtained by lashing additional poles above, and tightening the junctions by driving wedges between the ropes. Ledgers are horizontal poles, parallel with the wall, and secured by cords to the standards. The putlogs are cross pieces, generally of birch, placed at right angles to the wall, into which they are let in *putlog holes*, and the other end rests on the ledgers. Stout scaffold boards, hooped at the ends, are laid on the putlogs.

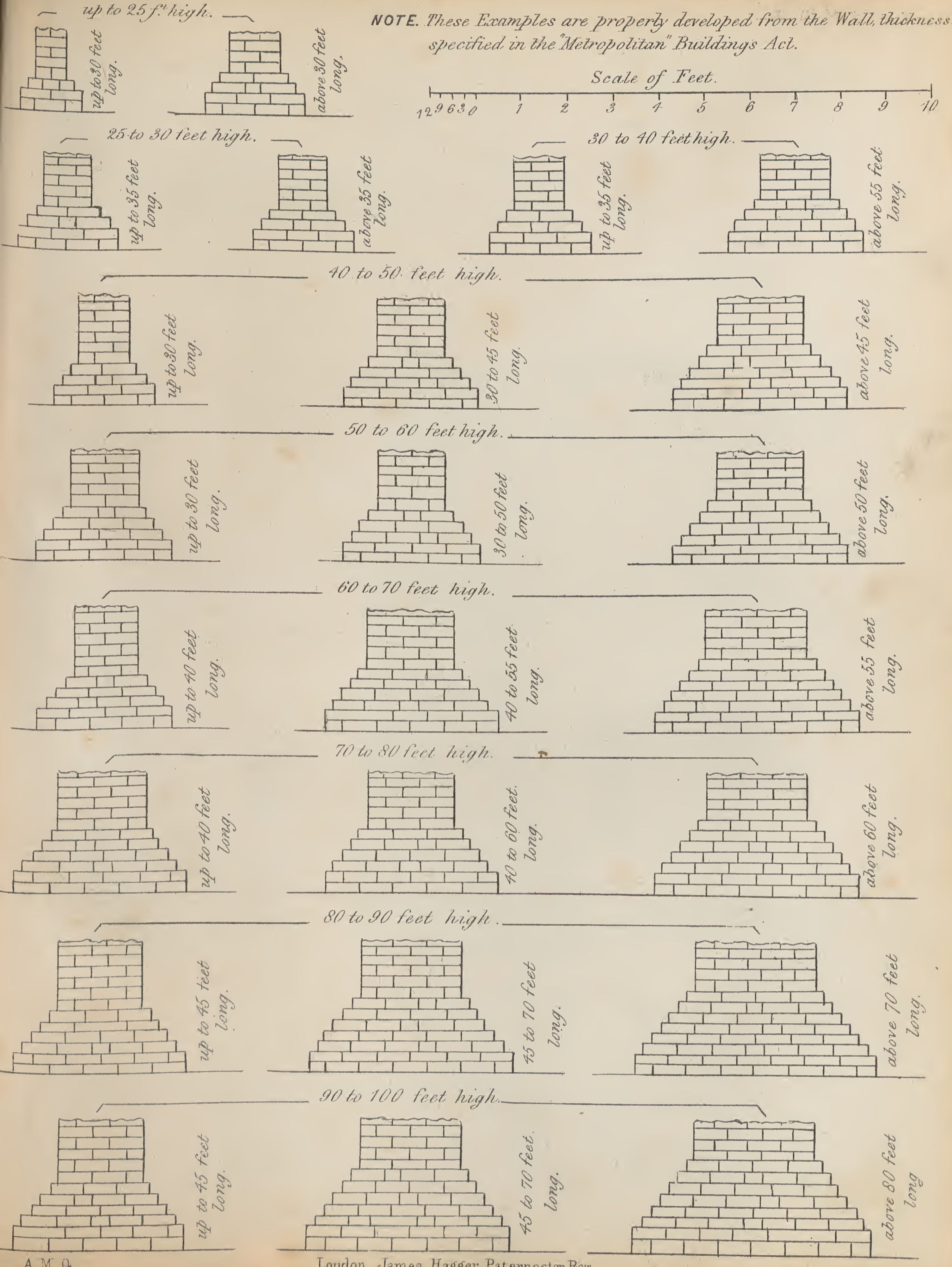
Next, as regards the foundations of walls, if the soil is of unstable character, concrete should be adopted. This is composed of stone lime slaked, in contact with gravel, sand, broken stones, flint, or river ballast. That used in the vicinity of London generally consists of six measures of clean gravel to one of lime, which should be tipped over from a barrow into the trenches, and not thrown from a height, as was formerly the practice, as the materials are then apt to separate. Particular care should be taken in excavating the trenches no wider than is absolutely necessary to take the concrete, in order that there may be an undiminished lateral support. The concrete may, under ordinary circumstances, be from two to four feet in depth, and about one and a half to twice the width of the lower course of footings; but as the material has little transverse strength, the depth should be carefully proportioned to the width. Stone landings, planking, and piling—the latter, when used at quoins, keeping them up, but allowing the intervening walls to sink—are now almost quite superseded by concrete in the erection of houses.

The footings must be carefully constructed with whole bricks, the hardest and best burnt being selected. The bottom courses should be double, and no back joints be allowed beyond the face of upper work, except in double courses, the projections also being kept very slight ($2\frac{1}{4}$ in. to $4\frac{1}{2}$ in.), or fracture of the footings, and consequent settlement of the wall, will probably occur. Mortar should be sparingly used; and sometimes footings are laid dry. On *Plate* 63, the proportions of footings for walls of various thickness, in accordance with the Metropolitan Buildings Act, are given; and on *Plate* 1*a*, *Figs.* 2 and 3, the ill effects of the defective construction above named, as respects both stone and brick, are indicated.

Where there are openings in the wall above, the best mode of equalising and distributing the superincumbent weight is by means of inverted arches. Of these we give an example in *Plate* 64, *Fig.* 1. One matter requires particular attention in constructing inverted arches. They should never be used unless there is a strong abutment for them on *both* sides, as any settlement will tend to force the side wall out of the perpendicular, as shewn in *Fig.* 2 in the

BASE COURSES AND FOOTINGS FOR DWELLING HOUSE WALLS OF ALL HEIGHTS.

NOTE. *These Examples are properly developed from the Wall, thicknesses specified in the "Metropolitan" Buildings Act.*



A M Q

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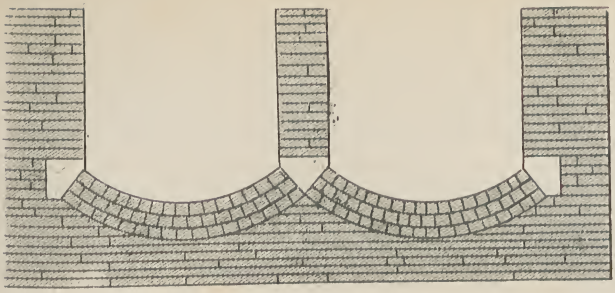


FIG. 1.

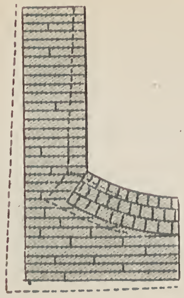


FIG. 2.

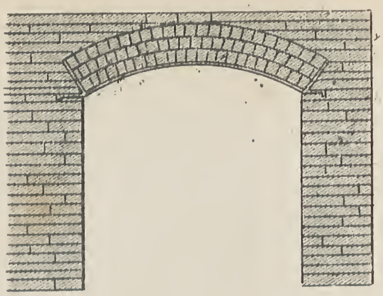


FIG. 3.

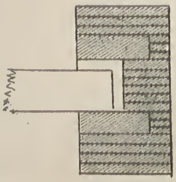
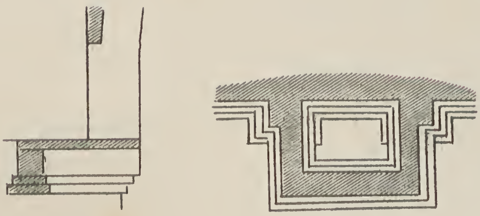
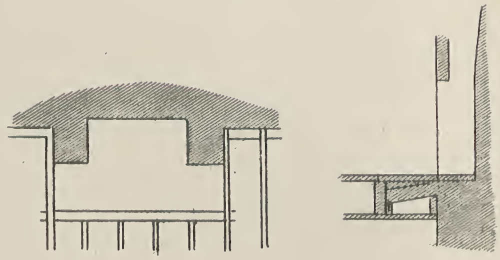


FIG. 4.



FIGS. 5.



FIGS. 6.

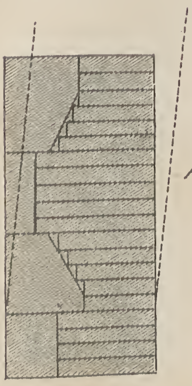
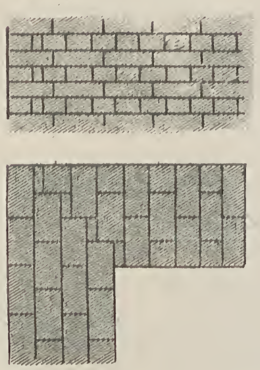


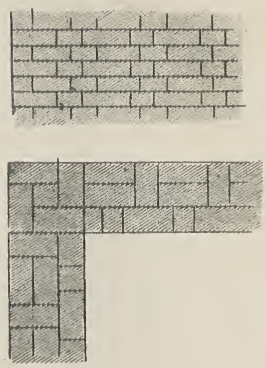
FIG. 7.

ELEVATION.

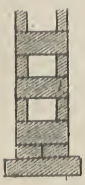


FIGS 8

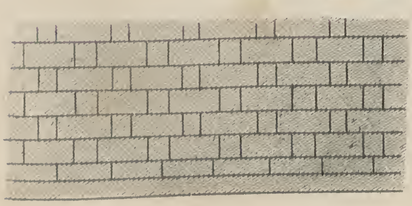
ELEVATION.



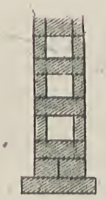
FIGS. 9



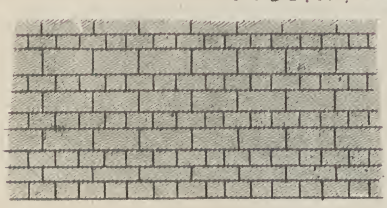
FIGS. 10.



ELEVATION.



FIGS. 11.



ELEVATION.

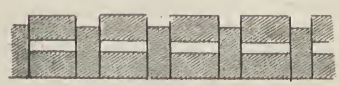
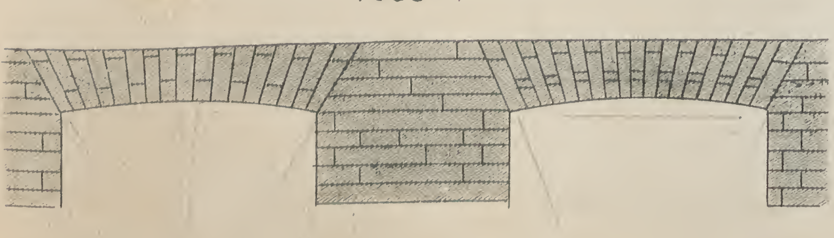
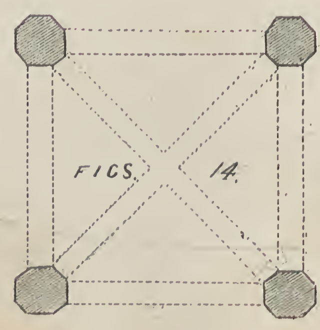


FIG. 12.



FIGS 13.



FIGS. 14.

same plate. When arches over apertures are turned near angles, the outward thrust should be counteracted by means of one or more iron bars, turned up at the ends, as in *Fig.* 3.

The walls should be carried up simultaneously level, never more than about four or five feet above another part at a time; otherwise, as the mortar shrinks and a general settlement (for this always occurs) takes place, if one portion of walling is much higher than another, it is obvious that the settlement must occur at different times, and that cracks and fissures will thus be induced. If, for any reason, one part is carried up above another during the progress of the works, it should not be toothed to take the remainder, but be racked, or sloped back at each end. All the internal joints ought to be flushed up with mortar, a matter often neglected from their not being seen; and thus they are hollow, and the damp penetrates to the interior. Toothing may be properly used when new walls adjoin, and are connected with, old ones; or when it is presumed that new work will not bear equally all along, by which means the junctions of the succeeding parts may be securely made with those first erected, when the latter have fully settled. Angles, and the junctions of return walls, require very sound construction; and piers are useful, as well in adding to the strength of walls, as increasing the base on which they stand. Sets-off, or diminutions in thickness, are best made equally on both sides, because of the greater stability thus ensured. *Corbelling* is carrying out brick-work to support flues, fire-places, cornices, &c. Flues, it may be mentioned, are usually made 9 in. by 9 in., 9 in. by 14 in., or 14 in. by 14 in. In the soundest construction joists should not be built into the walls, on account of the cutting up of the bond, the decay often induced at the ends, and the unequal bearing, unless strong plates are used: it is preferable to set out the plates, supporting them on brick or stone corbelling, or strong irons. Where there are heavy timbers or iron girders they should be laid on large pieces of hard stone, thus distributing the weight; this end being also promoted by introducing stones above; and the aperture left facilitates the circulation of air, of value in preserving the ends of timbers from the effects of damp, as it is at the ends that decay generally commences. This construction is shewn in *Fig.* 4. Trimmer walls in basements, and trimmer arches in upper floors, are used to carry the slabs of fire-places, and are illustrated in *Figs.* 5 and 6. Mortar joints should be as thin as possible, and the mortar or cement of a kind which sets quickly, in order that it may not be unequally pressed closely at varying times. From the too rapid drying which takes place in very hot weather, it is a good practice to steep the bricks in water previous to laying them, and also to water the walls at intervals. Four courses of brick-work are usually described to average 11½ in. or 1 ft. in height. Where walls are faced with stones, the latter should be properly squared to sizes that will bond securely with the brick-work, or the materials will be very liable to separate, and there will be defective vacuities, as shewn in *Fig.* 7. If ordinary bricks are faced with others of superior quality, as first or second malms, red or white bricks, they must be properly bonded together, as if of the same kind; and the headers of the superior bricks must, by no means, be cut in two, as is often done to save a few bricks, thus endangering the secure tie of the combination.

With reference to the methods of laying and connecting bricks, called *bond*, we should premise that a *stretcher* is a brick placed lengthways in the work, and that one placed in a

contrary direction, or headways, is a *header*. In England three kinds of bond are used, viz.—*English bond*, *Flemish bond*, including *herring bond*, and *garden wall bond*.

In *English bond*, *Fig*. 8, one course, called the *stretching course*, is laid with stretchers, and the next, called the *heading course*, is composed of headers. The stretchers thus bind the wall longitudinally, and the headers bind it transversely. It will be observed that it is necessary to introduce *bats*, or portions of bricks, at the angles, to preserve the continuity of the heading courses. A quarter brick, or bat, is called a *queen closer;* and a three-quarter brick, or bat, is named a *king closer*. English bond is the strongest and most durable kind of work; and it was adopted by the ancient Romans.

In *Flemish bond*, *Fig*. 9, headers and stretchers are used alternately in the same course. It is most generally employed at present on account of its presumed superiority over English bond in external appearance; but, in our opinion, there is no such superiority. There can be no doubt that Flemish bond is very inferior in point of strength. An effort is sometimes made to unite more firmly the stretchers in Flemish bond, and remedy its general weakness by means of bricks placed diagonally at an angle of 45°, parallel to one another, reversed in the alternate courses, and placed in the middle of thick walls. This, which is called *herring bond*, is but a clumsy expedient, as the triangular interstices prevent an efficient tie. With respect to the comparative strength of English and Flemish bond, Gwilt observes:—"The two principal matters to be considered in brick walling are, first, that the wall be as strong as possible in the direction of its length. Secondly, that it be so connected in its transverse direction that it should not be capable of separating in thicknesses. To produce the first, independent of the extraneous aid of bond timbers, plates, &c., it is clear that the method which affords the greatest quantity of longitudinal bond is to be preferred, as in the transverse direction is that which gives the greatest quantity of bond in direction of the thickness. We will, to exemplify this, take a piece of walling 4 bricks long, 4 bricks high, and 2 bricks thick, of English bond: in this will occur 32 stretchers, 24 headers, and 16 half headers, to break the joint, or prevent one joint falling over another. Now, in an equal piece of walling constructed in Flemish bond, there will occur only 20 stretchers and 42 headers; from which the great superiority of English bond may be at once inferred."

Garden wall bond is laid with three stretchers and one header, in walls nine inches in thickness; but when brick-and-a-half work is employed, Flemish bond is adopted. Piers, with a projection of 4½ in., are used to garden walls, the piers being about 10 feet apart, with rounded tops; and the upper part of the wall is finished with bricks on edge.

It is clear that the method of bonding bricks may be varied to a very considerable extent; but our limits prevent us entering at length into the subject. Much ingenuity has been exhibited in the devisal of hollow walls to exclude damp and promote warmth. In Silverlock's system Flemish bond is applied in the manner shewn in *Fig*. 10. The bricks are set on edge, breaking joint, and leaving internal cells the size of a brick. In Dearne's system the lower courses are executed in ordinary English bond, stretchers are laid above on edge, with headers laid flat over, so as to form a continuous hollow space, the work being thus carried up, as in *Fig*. 11. Loudon's system consists in simply leaving a space of 2 in. between the stretchers,

the headers being set the same distance within the internal face, and thus affording a secure key to plastering, as shewn in *Fig.* 12.

Bricknogging is a term applied to walls of bricks laid either flatways or on edge, with upright wood quarters 3 feet apart. It should only be used for internal partitions; and, generally, walls less than one brick thick should be executed in cement.

Bond timber, when used, should be in as long lengths as possible. Sometimes it is laid in the centre of the walls, and in other cases next the internal face; in which latter case it is useful for the attachment of wood dressings, skirtings, linings, &c. Bond is, however, preferable made of iron hooping, laid in long lengths, tarred, sanded, and lapped or folded together at all joinings, and bedded in cement. Tyermann's patent bond is a great improvement on the old variety; it is notched at intervals on both sides alternately, thus affording a secure key.

Arches are axed, gauged, and rubbed for the fronts of houses. They are set in mortar, lime only (called putty), or cement. Straight arches are constructed on the camber slip, and semi-circular, pointed, and elliptical on centres. *Figs.* 13 shew very common modes of constructing arches in London. The arch is first set out on a board, with the upper part of the arch straight, and the lower curved as the camber slip, forming a segment of a circle. The skewback is usually inclined at an angle of about 7 inches. The upper and lower parts are divided into a number of equal parts; the radiating lines are drawn; and the under part and the angles of the bricks are cut by means of the bevel, set off on the mould and numbered. Arches for wide spans should be turned in half-brick rings, breaking joint, and bonded with a whole brick where the joints meet: vertical bond should be introduced every three or four feet in the girts. The object of laying the bricks in half-brick rings is, of course, that the joints may be as uniform in thickness as is practicable.

The construction of niches is perhaps the most difficult work for the bricklayer. It is usual to form all the courses standing, and the bricks must thus be reduced very thin at the inner circle, as they cannot extend beyond the thickness of one brick at the crown.

Groining, or the intersectional angular curves formed by the meeting of vaults, and in which every brick has to be cut to a different bed, is also difficult practice. Vaulting has already been treated at considerable length; but we may mention here an ingenious method, invented by Mr. Tappen, of constructing groins rising from octagonal piers. *Fig.* 14 is a plan of the system. It presents increased strength over ordinary groining at the angles, and the band is carried, as will be observed, round the diagonals: by cutting off the angles of the piers enlarged space is also afforded below. For ordinary purposes in dwelling-houses, vaulting may be executed in one to two and a half brick rings, with the groin points, or arrises, accurately cut, and with the spandrels filled with brick-work up to the level of the internal ground of the vaulting, the whole being grouted with mortar. The lines for the centering of vaulting, and the fixing of the timbers, belong to the carpenter's department.

The construction of drains, sewers, cesspools, and wells, forms an important department of bricklaying. Drains are made of circular form, as nearly $\frac{13}{100}$ of the power is lost if a flat bottom is adopted. What are called *barrel* drains vary from 9 to about 18 inches in diameter. Up to about 15 inches diameter, they may be executed with half brick, and above that diameter

with brick rims. Sometimes there is a $4\frac{1}{2}$ inches bottom, and 9 inches arch. The lower half of the drains inside, and the upper half outside, should be rendered in cement. Brick drains are, however, now almost quite superseded by stoneware tubes, procurable in lengths of 2 feet up to 6 inches diameter, and above this diameter in lengths of 3 feet. These may be adopted up to diameters of about 18 inches, but if much above this size, their form is often not truly cylindrical, and brick-work should be substituted. The joints are formed by means of sockets; and the advantages of stoneware over brick drains consist in their being more rapidly laid, with less excavating, their impermeability to vermin, and their smoothness of surface, facilitating the passage of the refuse. With respect to the fall of drains, it should rarely be less than a $\frac{1}{4}$-inch in 10 feet. The cesspools to brick drains should be 1 foot deeper than the bottom of the latter; they may be 9 or 14 in. square at the feet of rain-water pipes, with sides and bottom half-brick thick, lined with cement and trapped with stone or slate. To drain surface water, the cesspools may be 14 or 18 in. square, executed as the above, and with dished York stones at the top, perforated and having iron rings: or there may be cast-iron gratings set in a rebate in the stone. These cesspools are also applicable to stoneware drains; but generally stoneware trapped contrivances are adopted; a pipe with a syphon bend being applicable to the feet of rain-water pipes, and various admirable stoneware yard traps being in use. Weeping drains have upright sides, half or one brick thick, tiled bottoms, and flat or arched tops. Drains may be laid in mortar or cement: punned clay is often used to stoneware junctions.

With respect to sewers, an elliptical form, with its greatest length in a vertical direction, and a reduced radius to the curved bottom, is found to be the most efficient. Bevel-shaped bricks and thin joints should be used. The fall may be about 1 in. in 10ft. Side entrances are provided for access to the sewer for cleansing and repairs; and gully-traps, with shoots, carry off the surface water: the latter may be of brick or stoneware. If the sewer is not required to be above 18 in. in diameter, stoneware may be adopted. The size of sewers must be carefully calculated by considering the number of persons in each house, the waste matter to be disposed of from each individual, the rain-fall, and allowance for the effect of storms, and also for the increase of the neighbourhood: then obtain the quantity passing through the sewer per minute, and so proportion the section as to allow of its passage.

Large cesspools for the reception of soilage, and tanks for that of water, may be either circular, or rectangular on plan. The sides may be executed in $4\frac{1}{2}$ or 9 ins. work, and the top should be domed, having a manhole and stone covering with iron ring. The bottom may be straight or inverted; and tanks should be rendered with pure cement. Cesspools are often divided so as to separate the liquid manure from the soilage; and tanks are sometimes so constructed as to admit of filtering the water. Wells above 6 feet in diameter should be steined to a thickness of one brick: if less than 6 feet, half-brick steining may be used. Malm paviors are best suited for steining; and the bricks may be laid dry, or in cement, or in blue lias lime. Elm is best adapted for curbs.

Brick paving is laid in sand, mortar, or cement; sometimes it is merely *grouted* after laying, —that is, thin mortar is poured over it. Ordinary stocks, malm paviors, Suffolk white and red bricks, paving bricks and tiles, and Dutch clinkers, are used. For each yard superficial there

are required,—36 stocks laid flat, or 52 on edge; 36 paving bricks laid flat, or 82 on edge; 140 Dutch clinkers; 9 twelve-inch paving tiles, and 13 ten-inch paving tiles.

In preparing mortar, the lime is first calcined by burning, then slaked by means of water, and afterwards mixed with sand for use. Chalk is pure carbonate of lime, but should not be used in building, as it sets too slowly, and in moist situations not at all. Smeaton observes that he "never found any limestone containing clay in any considerable quantity but what was good for water-works, the proportion of clayey matter, being burnt, acting strongly as a cement." Dorking, Merstham, Halling, and Guildford limes, much used about London, are slightly hydraulic, set hard, and bear exposure to moisture. Other strong limes are the blue lias of Somersetshire, the Bath brown lime, and the magnesian lime of Sunderland and South Shields. After burning, limestone becomes white or of an ochrey tint. Blue lias lime, or cement, should be used for work under water. The limestone is generally burnt in kilns, the average time of burning being about sixty hours; and that lime is preferred which heats most in slaking, and slakes most rapidly: all *core*, or unburnt stone, should be rejected. The sand should be procured from a river in preference to a pit: sea-sand is quite unsuitable, unless so thoroughly washed as to entirely get rid of the salt. The Thames river-sand makes excellent mortar. With respect to the proper proportions, three measures of sand are generally used to one of lime, the whole being thoroughly incorporated. Roman and Portland cements are very extensively used: the former is usually mixed with an equal quantity of sand; and the latter will take three measures of sand to one of the cement

The various kinds of bricks may be classed generally as follows:—

Malms are the best bricks. The finest, called *firsts*, or *cutters*, from having received an admixture of sand, and thus admitting of being cut and rubbed with facility, are used principally in arches. They are of a yellow colour; but there are red cutting bricks, called *rubbers*, differing from the common red stock. There are several qualities of each kind of malm, various prices being charged. A distinct variety is called *seconds*, from not being so uniform and bright in colour as the firsts. They are used in arching, but principally for the fronts of superior buildings.

With reference to the different colour of bricks, it depends on the chemical composition of the constituents, and is rarely of the natural colour of the clay before burning. The presence of iron, lime, magnesia, and metallic oxides, the nature of the sand used, and the degree of firing, affect the tint of bricks. Thus, Staffordshire bricks, at first red, change to a greenish blue on additional heat being generated. Some clays burn of a beautiful white colour, as Suffolk bricks; others are bright clear yellow; others grey; and others of a rich brimstone colour. In some bricks, such as black headers, a smooth glazed surface is produced.

Stocks are the ordinary building bricks, and are red, grey, or yellow. The red are burnt in kilns; the colour of grey stocks is very irregular; *washed stocks* are the worst kind of malms; and *rough stocks* are sound, but of uneven shape and colour.

Paviors are excellent building bricks, but not, as the name would seem to indicate, used exclusively for paving. *Rough paviors* are the most irregular ones.

Paving bricks are used for paving; and we have already indicated the kinds used, as well as *paving tiles*.

Compass bricks are circular on plan, and are used for steining wells and for other purposes.

Concave bricks are flat on one side and hollow on the other, and are thus suitable for drains and watercourses.

The shape of bricks is varied very considerably for specific purposes. They are splayed for plinths, door and window jambs and cornices; weathered, throated and rounded for copings; bevelled or wedge-shaped for culverts and sewers, and moulded in various forms for cornices and dressings.

Dutch clinkers, used for paving, and in cisterns, soap-boilers, vaults, &c., are chiefly manufactured at Moor, a village near Gouda in South Holland, the material being the slime on the shores of the river Yssel, and sand from the banks of the Maes. They are of greyish colour, and exceedingly hard. The dimensions are $6 \times 4 \times 1\frac{3}{4}$ inches, and $6 \times 3 \times 1$ inches. They are often laid in herring-bone pattern. For stables they have been objected to as being too hot for the horses' feet.

Fire bricks are so called from their power of resisting the violent action of fire. They are $9 \times 4\frac{1}{2} \times 1\frac{1}{2}$ in., and are of close texture and dark red colour. Fire clay is found in various localities. The fire bricks from Stourbridge are considered the best,—next, those from Wales,—and lastly, those from Hedgerly, a village near Windsor, and which are much used about London.

Place bricks, sometimes called *peckings*, or *sandel*, or *samel bricks*, are those which, from being placed furthest from the fire, are insufficiently burnt. They are only suitable for the most common purposes, being soft and of uneven texture. Outside bricks, called *burnovers*, are frequently laid aside and reburnt.

Burrs, or *clinkers*, are overburnt bricks: sometimes a vast number are found run together in one mass. They are suitable for artificial rock-work and such-like purposes.

Grizzles are soft, tender bricks.

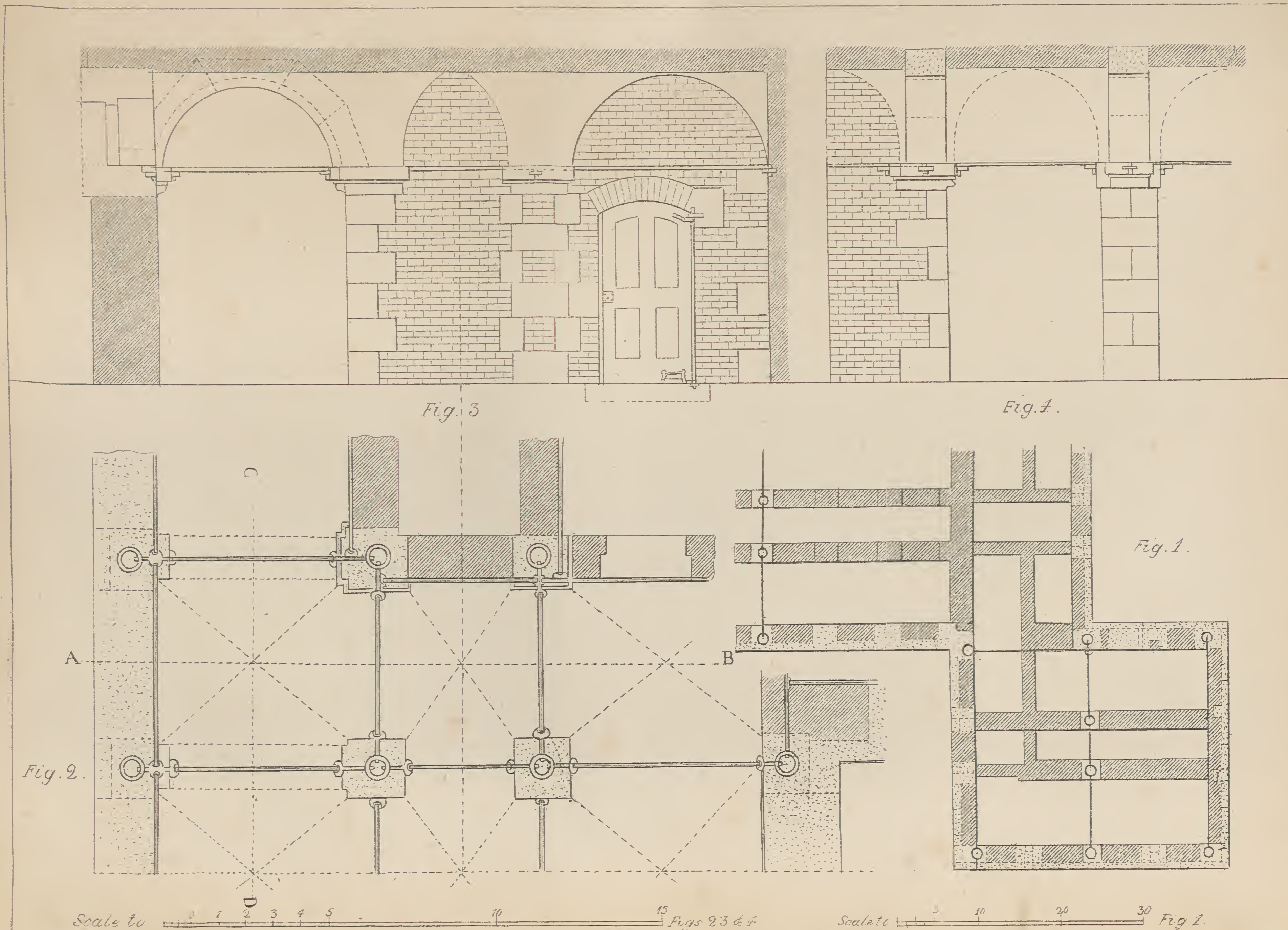
Shuffs are full of shakes, or shuffy.

Bats are refuse pieces of brick.

Brick-work is measured and valued by the *rod*. This is a solid mass $16\frac{1}{2}$ ft. square, or $272\frac{1}{4}$ feet superficial, $1\frac{1}{2}$ brick in thickness. The odd 3 in. are, by general consent, not considered in estimating. Walls which are more or less than $1\frac{1}{2}$ brick in thickness may be reduced to that dimension by multiplying the area of the wall by the number of half bricks in thickness, dividing this product by 3, or the number of half bricks in a brick and a half, and dividing the quotient by 272. To reduce cubic feet of brick-work to rods, multiply by 8 (the number of $1\frac{1}{2}$ in. in a foot) and divide by 9 (the number of $1\frac{1}{2}$ in., in a brick and a half); then divide by 272. Or, divide by 306 (the number of cubic feet to a rod), and deal with the odd feet remaining by the first rule. It should be mentioned, that in some country districts brick-work is measured by the yard super, and priced according to its thickness.

For one rod of brick-work, with every four courses one foot in height, 4352 stock bricks are required, or 4533 if the four courses are only $11\frac{1}{2}$ in. in height. If the bricks are laid dry, 5371 are required. $3\frac{1}{2}$ loads of sand and 1 cubic yard of stone lime, or 36 bushels of cement

BRICKWORK—CHAIN BOND &c.



to an equal quantity of sand, are necessary to the rod. Assisted by a labourer, an able workman will lay 1000 stock bricks in a day: the wages of the bricklayer are from 4*s.* to 5*s.* 6*d.*, and of the labourer from 2*s.* 6*d.* to 3*s.* 6*d.* per diem.

In *Plate* 65 and 66 we continue illustration of some peculiarities in wall construction, as the same are exhibited where particular requirements call for extra strength and precaution.

A very prevalent and effective preventive to the disruption of the foundations and other parts of large buildings, where continuous junction of parts is not always attainable, is the introduction of what is denominated chain-bond. This bond is sometimes of timber, and oak has been lately used for the purpose, but metal properly protected from oxidation is preferable on many accounts. A very good example of the practice, and where metallic material is employed, exists in the Cold Bath Fields House of Correction. Here chain-bond is used very profusely, being introduced at the base of each floor, and intermediately at the springing of the arches or arcades of each. We give in *Fig.* 1, in the plate just mentioned, a portion of the plan of the south-east end, or wing, of this building, shewing the chain-bond inserted at the base of the ground floor; and in *Fig.* 2, to a larger scale, the more complicated arrangements in the iron-work introduced at the level of the springing of the arcades,

Fig. 3, being a longitudinal section on the line A, B, of the latter; and

Fig. 4, a transverse section on the line C, D.

As will be seen, the system is that of connection by bar and socket, or eye, the latter being attached to circular rings bedded in the stone-work of the walls and pier-caps, to receive hooks or calkings formed in the ends of the latter. The size of the bars, where the same are free of the walls, is one and a half inch square; where they lie on the walls they are flat bars, three inches wide, and half an inch thick.

This introduction of chain-bond, either in wood or metal, is a very old practice, and appears in many instances, as we have already had occasion to notice when treating of such applications in reference to stone-work, (see pages 69 and 74).

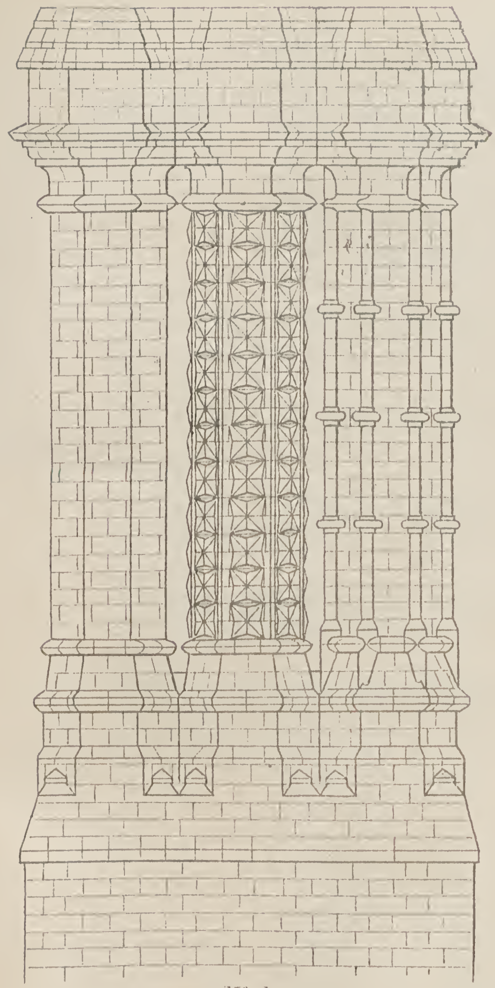
The observations which we have there made will render it unnecessary to do more than caution the bricklayer, in the use of the metal descriptions of tie or bond in his work, against any neglect of a thorough provision for the prevention and consequent action of moisture. Where the tie is enclosed within the brick-work, it should be previously slightly heated and coated with oil; and methods similar to those described when speaking of the insertion of the iron dowels, &c., in the remarks on light-houses, might with great advantage be adopted where the connecting rings, &c., such as those shewn in *Plate* 65 and 66, are attached to the stone portion of the walling. It should be noticed that these rings are let into a sunk channel cut in the stone to receive them, the horizontal rods connecting the sockets with the same being also sunk to the same level, and rivetted or secured by nut and screw to the rings.

We now come to the consideration of other than the ordinary forms, and the more artistic applications of brick to which we referred at p. 241; that is to say, to what may be distinguished as

ORNAMENTAL BRICKWORK.—In a previous page we have alluded incidentally to the alteration effected by the removal of the restrictions on the employment of bricks moulded to ornamental forms. In the streets of London and most of the larger towns in England, the reader can

scarcely fail now to remark the extent to which this has affected construction in this material. Cheerful edifices, faced with bricks of different colours, having their cornices, stringcourses, and other decorative details formed in moulded and cut brick-work, now meet the eye in all directions, and are generally superseding the external applications of plaster formerly so frequent, and so often used to induce the false idea of a stone building, or, what is even still more objectionable, to cover materials of the worst description. We are happily, however, fast passing away from this state of things, and returning to the older and more genuine practices of our forefathers as respects the employment and the adaptations to ornamental purposes of this material in its natural and uncompromised state; for it is to be observed that ornamental brick-work is by no means a modern introduction or innovation. The Chinese have long excelled in its application. Terra-cotta cornices and bas-reliefs were used in ancient Greece. In ancient Rome the ornamental parts of many edifices, even Corinthian capitals, were carved in brick-work. An edifice still exists, near the grotto of Egeria, in which the cornices, modillions, dentils, and other decorative features, are cut in yellow bricks closely cemented together. While in England bricks have, until recently, speaking with reference to modern practice, been considered as only fit for the most ordinary buildings, owing principally to the restrictions in size and shape, and their generally repulsive colour. The ancient Romans fully appreciated their applicability to decorative purposes. As Hope remarks:—"Wherever they found clay more abundant, or easier to work than stone, they used it plentifully, both in regular layers throughout the body of walls, as we do, and in an external reticulated coating, from the fineness of its texture and the firmness of its joints, as durable as stone itself. Indeed, far from considering brick only as a material fit for the coarsest and most indispensable ground-work of architecture, they regarded it as equally fit for all the elegancies of ornamental form—all the details of rich architraves, capitals, friezes, cornices, and other embellishments. Sometimes it owed to the mould its various forms, and at others, as at the Amphitheatrum Castrense, and the temple of the god Ridiculus, to the chisel." (*Essay on Architecture.*) The revival of brick-work in the Mediæval structures of Italy has before been alluded to; and Mr. Street's work, "Brick and Marble in the Middle Ages," has been extremely useful in drawing attention to the subject, and also furnishing suggestions for numerous contemporary structures. The buildings in Lombardy, Pavia, Milan, Mantua, Verona, and other cities, present very exquisite examples of decoration in clay. In Holland, Belgium, Hanover, and France (particularly in Toulouse), old ornamental brick-work abounds; and, together with that in the Marien Kirche at Brandenburg, and other structures in North Prussia, deserves more careful study than has hitherto been generally devoted to it. In the Perpendicular style, in England, moulded and ornamental brick-work appears largely in the case of chimney-shafts, some of which are of a very elaborate character. In the Tudor period of this style, several other introductions of it also occur. There is a very fine example at Eastbury, to which we shall presently refer. As respects chimneys, some of the richest specimens are to be seen at Thornbury Castle, Gloucestershire, and Oxburgh Hall, Norfolk. Others less ornate occur in a number of nstances, both singly, as in Framlingham Castle, and in groups or stacks of two or more conjoined. There is a very good example of two at an inn in the High Street of Saxmunham, in Suffolk.

PLATE 67



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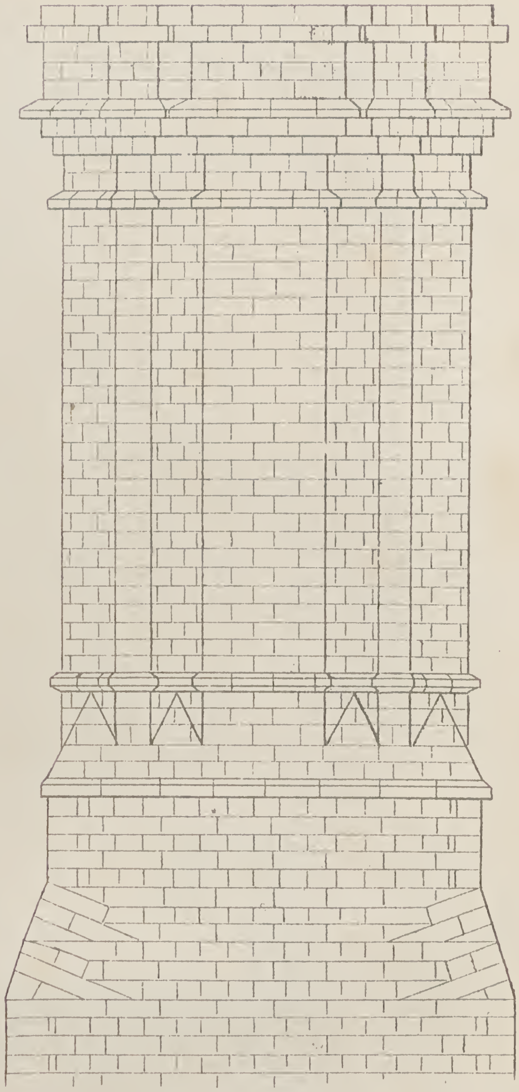

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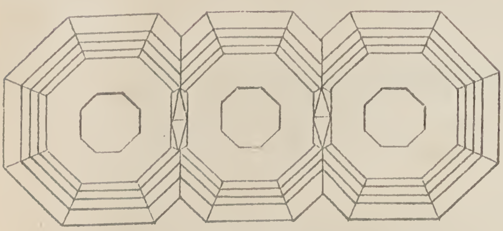

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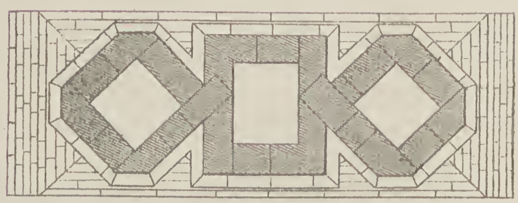

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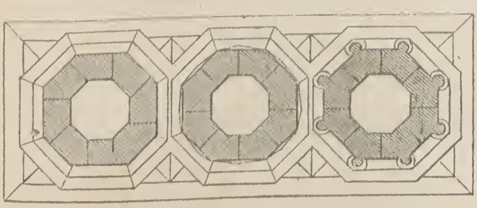

Nº 3.

D. RUDDLE ARCH^T

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CHIMNEYS—GOTHIC.

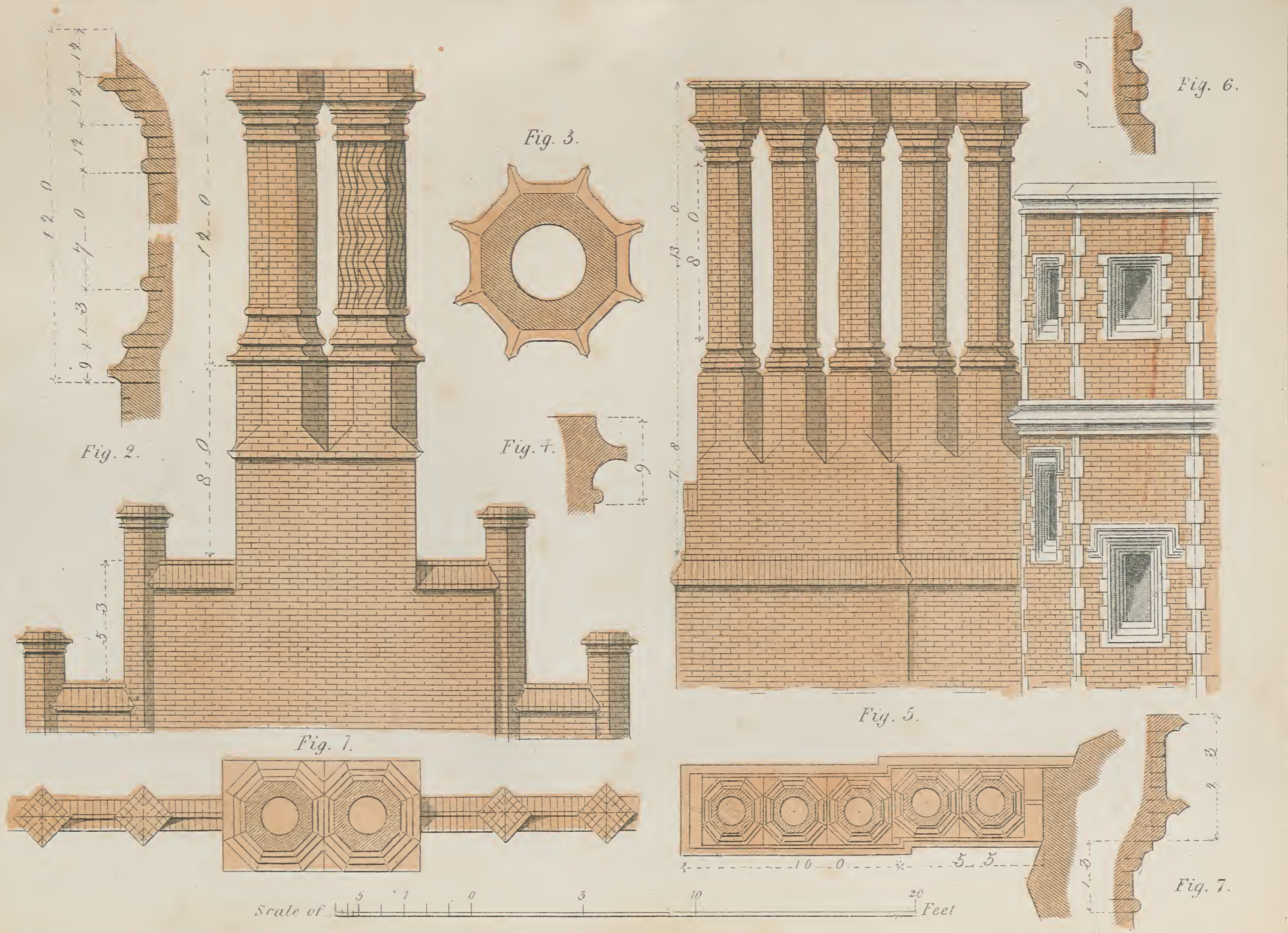


Fig. 1.

Fig. 2.

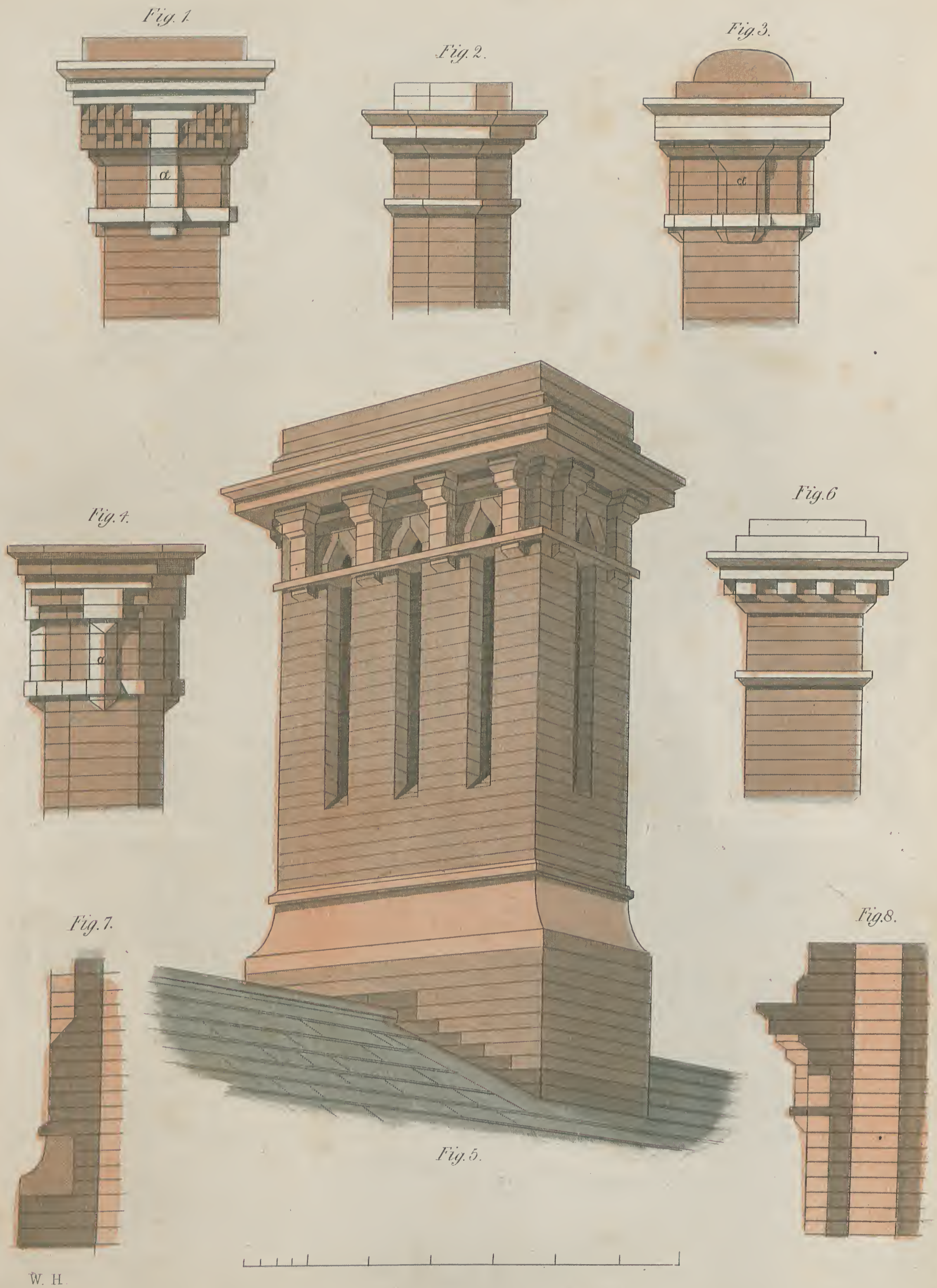
Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.



London. James Hagger, 67, Paternoster Row.

Of a group of three, of the richer and plainer kind, we give example in *Plate* 67

Fig. 1, being a geometrical elevation of the former with

Fig. 2, a plan of the caps, and

Fig. 3, a plan or horizontal section through the shafts.

Fig. 4, is a like geometrical elevation of the latter or plainer kind.

Fig. 5, the plan of the same, shewing the mode of bonding the bricks of the shaft.

In *Plate* 68 and 69, we give another group of two, and also one of five shafts. The former is from Titchfield Place House, Hants, and the latter from Eastbury House in Essex, before mentioned. The first, as will be seen in the elevation, *Fig.* 1, in the plate, contains two shafts, octagon on plan, conjoined at the cap and base, and forms the termination of a stepped gable, the angles of which are finished with pinnacles. One of the shafts is enriched with a zigzag ornament; the other is plain.

Fig. 2, gives a vertical section of the shaft, shewing the joints of the several courses.

Fig. 3, the plan of the cap, and

Fig. 4, a section through the cap moulding of the gable pinnacles.

Fig. 5, shews plan and elevation of the larger chimney-stack at Eastbury, which abuts on the staircase tower in the back court. It consists, as shewn, of five shafts, all plain; the two immediately against the tower being recessed slightly from the other three. The execution of the work in this case, as it is throughout the house, which is all of brick—the angle quoins and window dressings and labels being coated with cement—is of the highest order, and is altogether one of the finest specimens of old brick-work in the kingdom.

Fig. 6, is a section of the base of the shafts, and

Fig. 7, a like section through the cap.

The other examples of moulding and ornamental brick-work are to be seen in the decoration of doors and windows, and to cornices. There is an interesting example of its application to the first mentioned at Eastbury, just noticed. Sometimes towards the later periods different coloured bricks were combined with the more general dark red. During the reign of Henry VIII., Holbein carried out some very satisfactory ornamental brick-work, combining it with tiles and terra-cotta. At Sutton Park, Surrey, a house of that period, cream-coloured bricks are used, which, like the front of the Farnese Palace at Rome, are often taken for stone. Later, Inigo Jones and other eminent architects designed decorative brick-work in a less characteristic style than that of Holbein, but still fine specimens of workmanship; and of which the ornamental front, No. 43, St. Martin's Lane, London, with bricks carved after laying, will give a notion.

As an idea for the employment of different coloured bricks, after the fashion of the first alluded to, though of more simple character, inasmuch as white brick supplies the place of terra-cotta introductions, we refer to *Plate* 70. In the designs here given, which are those for chimney-stacks of Italian character, but two colours are made use of—red and white. It is unnecessary to say that others may be added with good effect, if judiciously disposed, as in the example of coloured brick and stone in combination, of which we shall hereafter give an illustration. In the present case it is to be noted that the effect is sought

to be obtained with a moderate amount only of labour in the execution, and without more than such an amount of colour as is generally admissible. With a view to economy, moulded brick, it will be observed, is omitted, splayed bricks being substituted, and the cutting, wherever introduced, of a perfectly simple kind.

As will be seen, *Figs.* 1, 3 and 4, represent single shafts. If either of these be adopted in a stack of two or more flues, the parts or projections marked *a, a, a,* should be repeated at intervals of about two feet throughout the length of the stack.

Fig. 2, octagon on plan, may serve for a detached shaft, or for a group of shafts, attached at the cap and base, or for a straight stack with canted ends.

Fig. 5, is the perspective view of a conjoined group of flues. The cornice of the cap, with the necking and the base moulding, might be in stone, or formed in cut white brick to accord with the consoles or brackets.

Fig. 6, is one of the sides of a single shaft, or the end elevation of a lengthened shaft.

Fig. 7, is the section of the base moulding of *Fig. 5*; and

Fig. 8, a section through the cap.

The portions shewn as white, indicate white brick; or stone might be substituted.

In the five plates to which we shall next refer, numbered respectively 71, 72, 73, 74, and 74*a*, distinguished as "Combinations of brick and stone-work," coloured bricks are more fully introduced, and in greater variety of colour than in the examples previously given. The applications are also extended to several other features, both accessory and constructive, and illustrate in each case the varied effects that may be produced by the use of bricks of various colours combined with stone or other material of a like kind.

The courses and joints of the bricks are shewn, so that there can be no difficulty in the practical execution. But the examples are intended rather as hints, or suggestions for other combinations, either more simple or more elaborate, than to be copied without alteration; such copyism, excluding as it does individual thought and taste, being destructive of all true art. They may also be considered as exhibiting that system of treatment which is legitimately ornamental brick-work; since the architectural example before mentioned, in Saint Martin's Lane, is illustrative of the skill of the mason or carver, rather than, strictly speaking, of that of the bricklayer. Modes of *laying*, or combining bricks, either alone or in conjunction with other materials—stone, marble, tiles, &c.—is thus peculiarly ornamental brick-*work*. It should be remarked that the details of ornamental brick-work ought to be small, regard being had to the size of the materials, which, if much less than that of the decorative forms adopted, will induce in the latter an appearance of disproportionate largeness. Fergusson observes:—"Sublimity is not perhaps to be attained in brick-work; the parts are too small; and if splendour is aimed at, it may require some larger and more costly material to produce the desired effect; but there is no beauty of detail or design on a small scale that may not be obtained by the use of moulded bricks, and they are in themselves far more durable, and if carefully burnt, retain their sharpness of outline longer, than most kinds of stone. Where the details are small, and designed with taste, the effect is almost equal to stone; but where the details are themselves on a large scale, as is sometimes the case, the smallness of the materials becomes apparent." (*Handbook of Architecture.*)

COMBINATIONS OF BRICK AND STONE WORK.

.TARBUCK.

1 2 3 4 5 6 7 8 9 10 FEET.

COMBINATIONS OF BRICK AND STONE WORK.

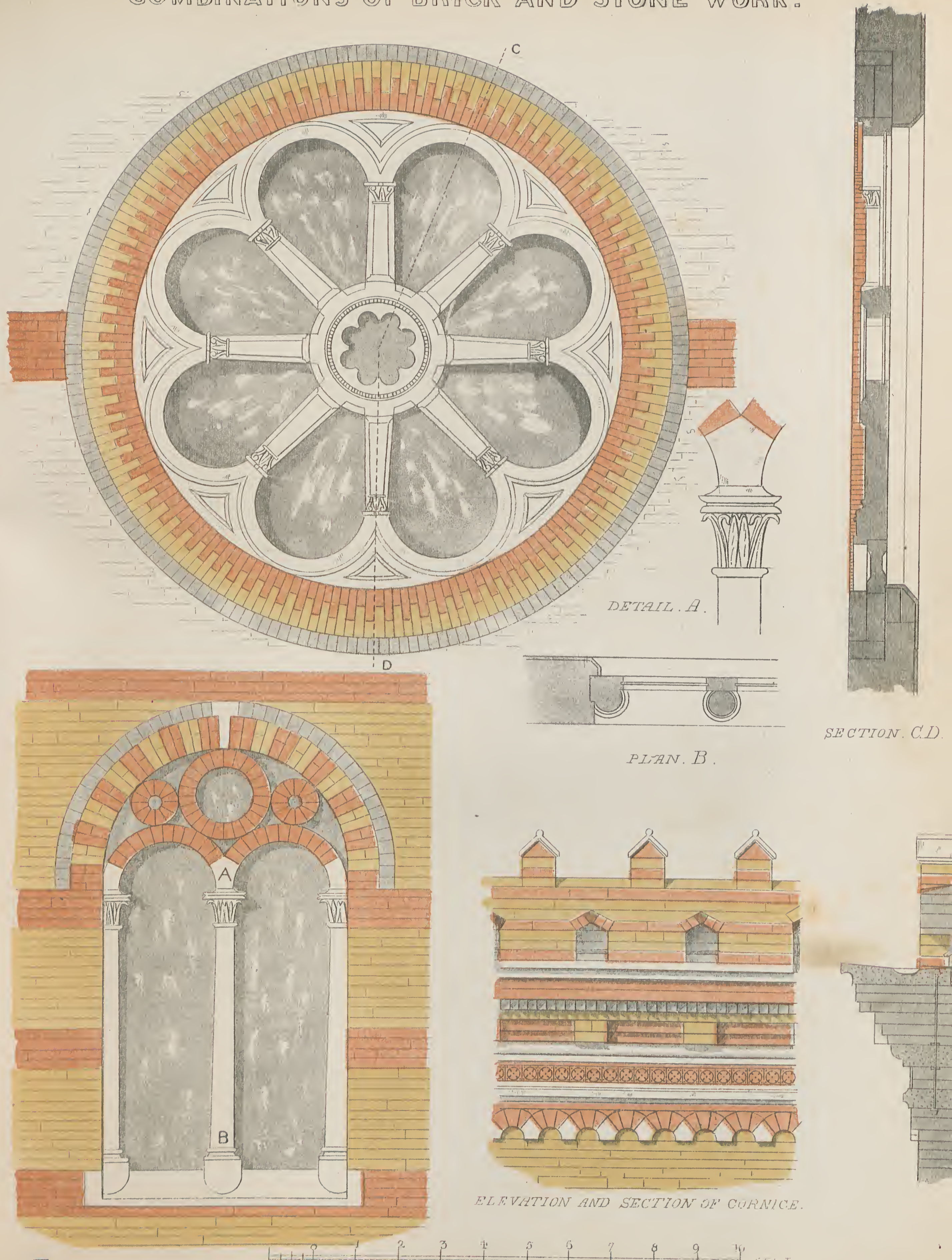
E.L. TARBUCK.

COMBINATIONS OF BRICK AND STONE WORK.

1 2 3 4 5 6 7 8 9 10 FEET.

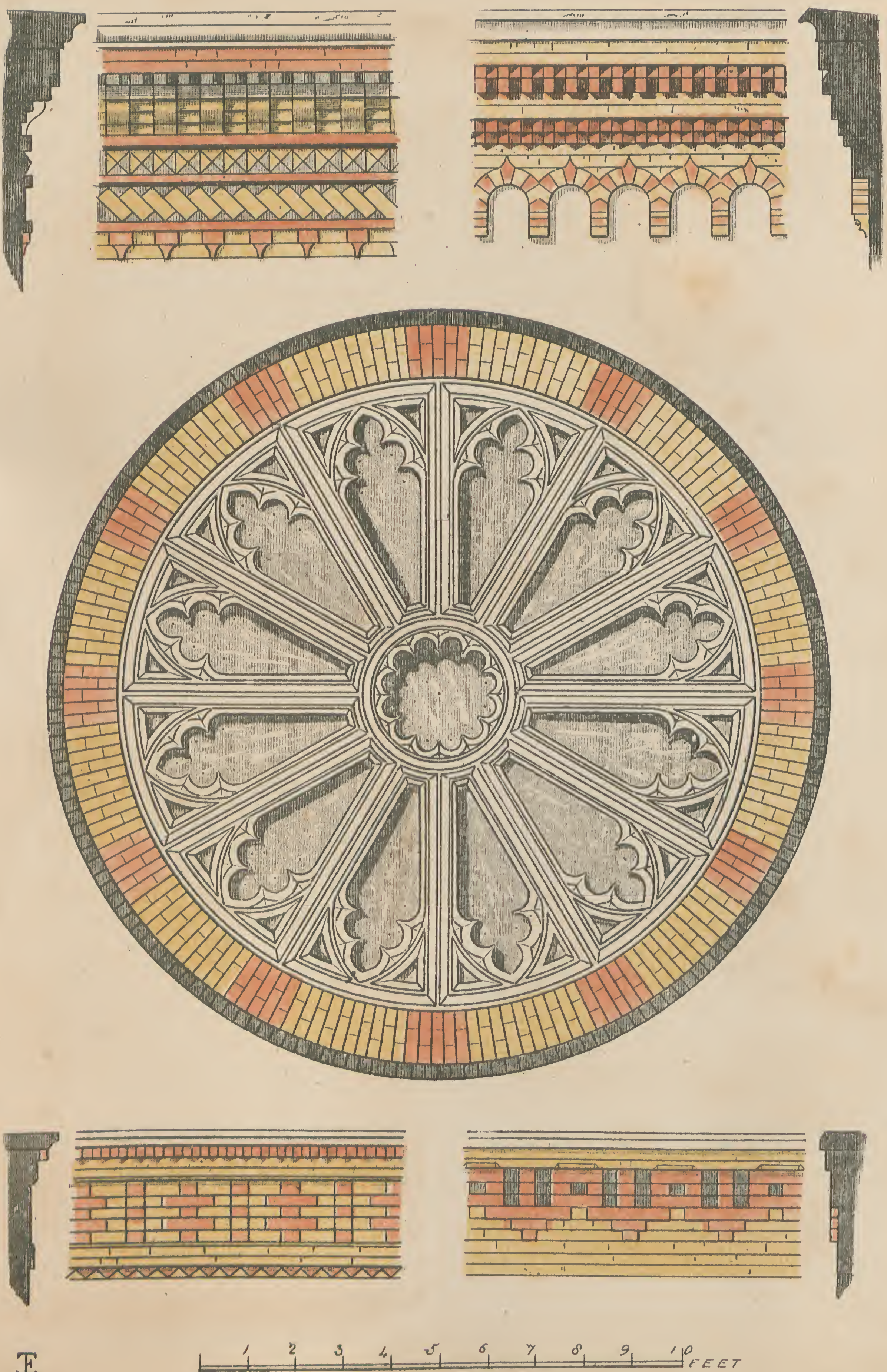
E. L. TARBUCK.

COMBINATIONS OF BRICK AND STONE WORK.



London, James Hagger 67 Paternoster Row.

COMBINATIONS OF BRICK & STONE WORK.

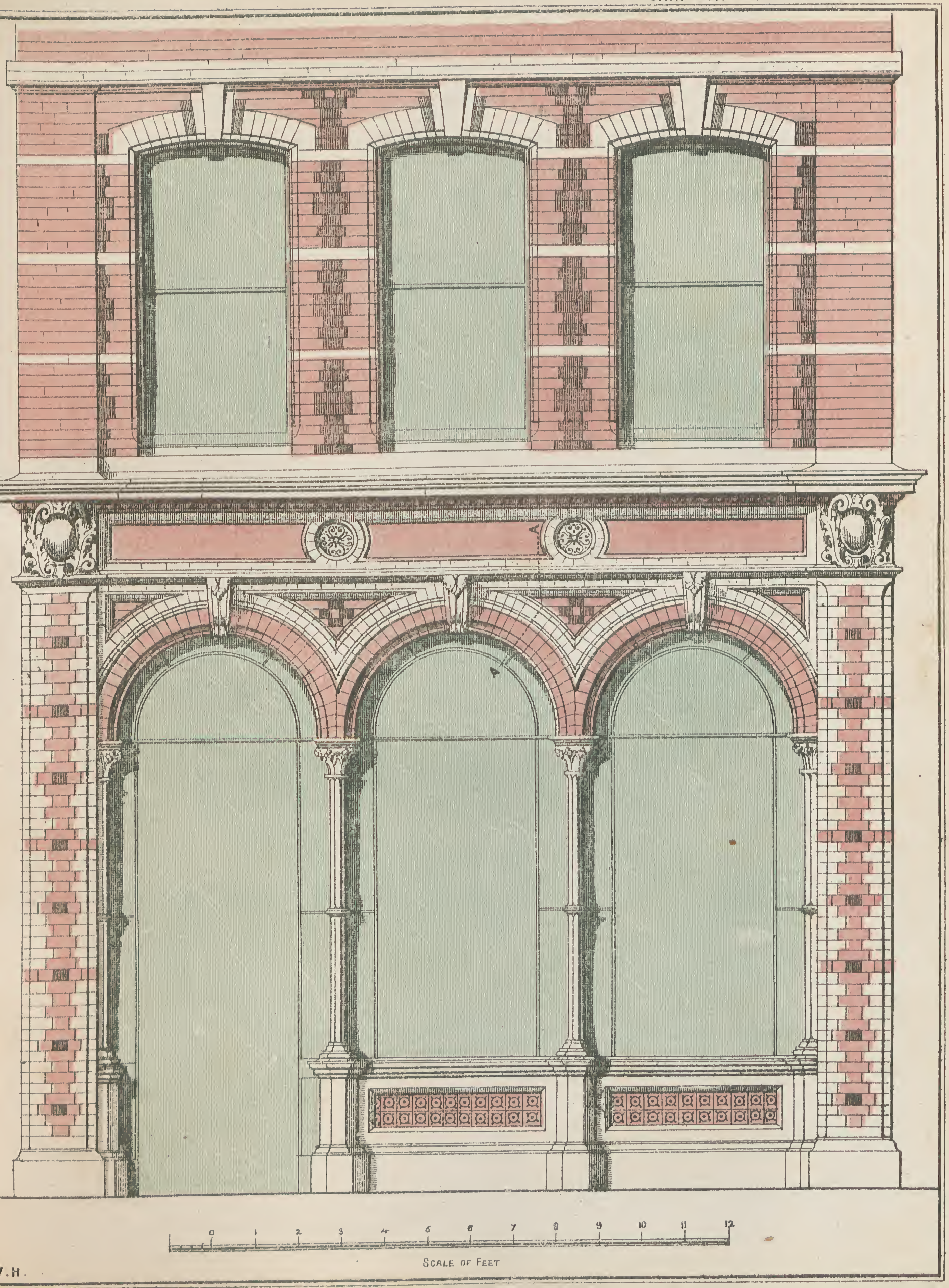


E

DESIGN FOR A SHOP FRONT.

PLATE 15.

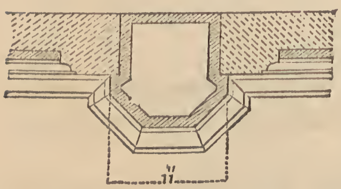
ORNAMENTAL BRICKWORK.



The bricks used are to be moulded, cut, and rubbed into the required shapes, and the general facing may be of sound yellow stocks of uniform size and colour, or, still better, of yellow second malms. If white bricks are adopted in some cases instead of stone, they may be white Suffolks, which are from £3 to £3 15*s.* per thousand. White door-jambs and splays are about £4 10*s.* per thousand, and red £3 10*s.* Red rubbers (£4 15*s.*) and yellow cutters (£5 10*s.*) may be used to the arches, and red Suffolks (£3 5*s.*) to the horizontal courses so tinted. Black glazed or grey headers (£4), and black rubbers, or blue dressed bricks (£5 10*s.*), may be employed for the dark-coloured bricks.

The bricks must be laid in rather fine mortar, and the pointing carefully executed. Cement, coal-ash, blue lias lime and sand, burnt clay, sand and lime, white gauged stuff, and other materials, are used in pointing. The ordinary horizontal brick-work may be finished with a neat flat joint, or tuck-pointed, the latter being more expensive.

It will be seen that the suggestions embodied in the above-mentioned plates embrace applications of the coloured material to the decoration of doors, windows, parapets, cornices and strings,&c. &c., including (in *Plate* 73) an elevation which might readily be adopted as an entire shop-front, with very good effect. In *Plate* 75 we give another idea of the same kind, but more directly arranged for the purpose. In this design red and white brick is the material chiefly made use of. The stone-work proposed to be introduced is limited to the upper members of the cornice, the key-stones of the arches, the enriched shields, and the dado under the cast-iron columns. The columns supporting the arches are intended to be of cast iron, with enriched capitals of leaves and flowers. The pedestals beneath them might be of the same material instead of stone, together with the capping of the dado, back joints being provided in the castings for the proper fixing of the masonry. The adjoining Figure is a plan of one of the pedestals so executed, shewing the method of fixing the stone-work between them.



The panels of the dado might be enriched, as shewn, by the introduction of encaustic tiles, to be let into the stone-work; and the best pattern would be a simple diaper with a red ground, so as to harmonise with the brick-work of the front.

If the height of the superstructure be considerable, it would be necessary to introduce additional cast-iron supports, standing immediately behind those shewn in the elevation, and which may be of any convenient form to receive the sash.

The panels in the frieze of the shop front would receive the name of the proprietor, and the number of the house; or, if necessary, the panel might be made continuous by omitting the enriched circles; but, for the sake of better architectural effect, it would be desirable they should be retained.

The design of the first-floor windows might be repeated, with some little variation, in those of the upper floors; and, for a more extended frontage, five arches might very well be introduced between the outer piers, with a second doorway and an additional division or compartment to the shop below.

The mouldings of the arches are of a simple character, and the annexed Cut (which is a section on the line A A) gives the outline of them. Those of the cornice of the shop-front are sufficiently shewn in the elevation. The angles of the lower piers are simply chamfered; those of the windows above have a staff bead worked thereon, returned over the head, and stopped against the key-stone and at the foot.

The illustrations we have above given, as will be seen, relate principally to Italian forms and character of design. We now propose to shew the applicability of the same, or similar kinds of material, to such as are characteristic of the Northern Mediæval, or Gothic. With this view, *Plate* 76 exhibits two ideas for a Gothic shop-front, executed in the same manner in coloured bricks and stone. It will be unnecessary, in referring to this plate, since the same sufficiently explains the designs, to do more than state that the red and black tints indicate in each case, as in the previous examples, bricks of corresponding colour, and the parts left white, stone with white or yellow bricks. The brestsummer, in *Fig.* 1, would be of timber, as might be the cornice and moulded work above it, though here shewn as stone. In *Fig.* 2, timber would be limited to the sashes and other portions beneath the arch of the front. This latter, it may be observed, shews a Southern, and *Fig.* 1 a Northern phase, of the Gothic style.

CHAPTER XXIII.

ON PLASTERING.

We now come to the consideration of the third and the fourth main divisions of our work,—the latter being the concluding one—namely, Plastering, General and Ornamental, and Decoration.

PLASTERING generally has been defined to include "every thing that relates to the spreading evenly and smoothly on the surface of our walls, externally as well as internally, and on our ceilings, a composition of mortar or cement." Technically, the application of this composition to walls is called *rendering*, and to ceilings and partitions formed of timber, *lathing and plastering*. The operation consists, according to the quality of the work desired, of a certain number of these applications one upon another. The first coat, speaking more particularly with reference to internal work, is called the *pricking-up coat*, and consists of a coat of lime and hair, spread upon a wall or partition, equally thick on every part, and afterwards marked over in alternate diagonal lines, to form a key or hold for the succeeding coat, which is called the *floating coat*. The third coat is called the *setting coat*, being composed of a thin coat of putty called *setting*, and is usually applied when the floating has become firm. This is the process in good and well-finished work. There are other modes of proceeding followed for economy, where the higher degree of finish is not required. The three courses of render, float, and set, as applied to walls; and lath plaster, float, and set, as applied to ceilings and

DESIGN FOR SHOP-FRONTS.—GOTHIC.

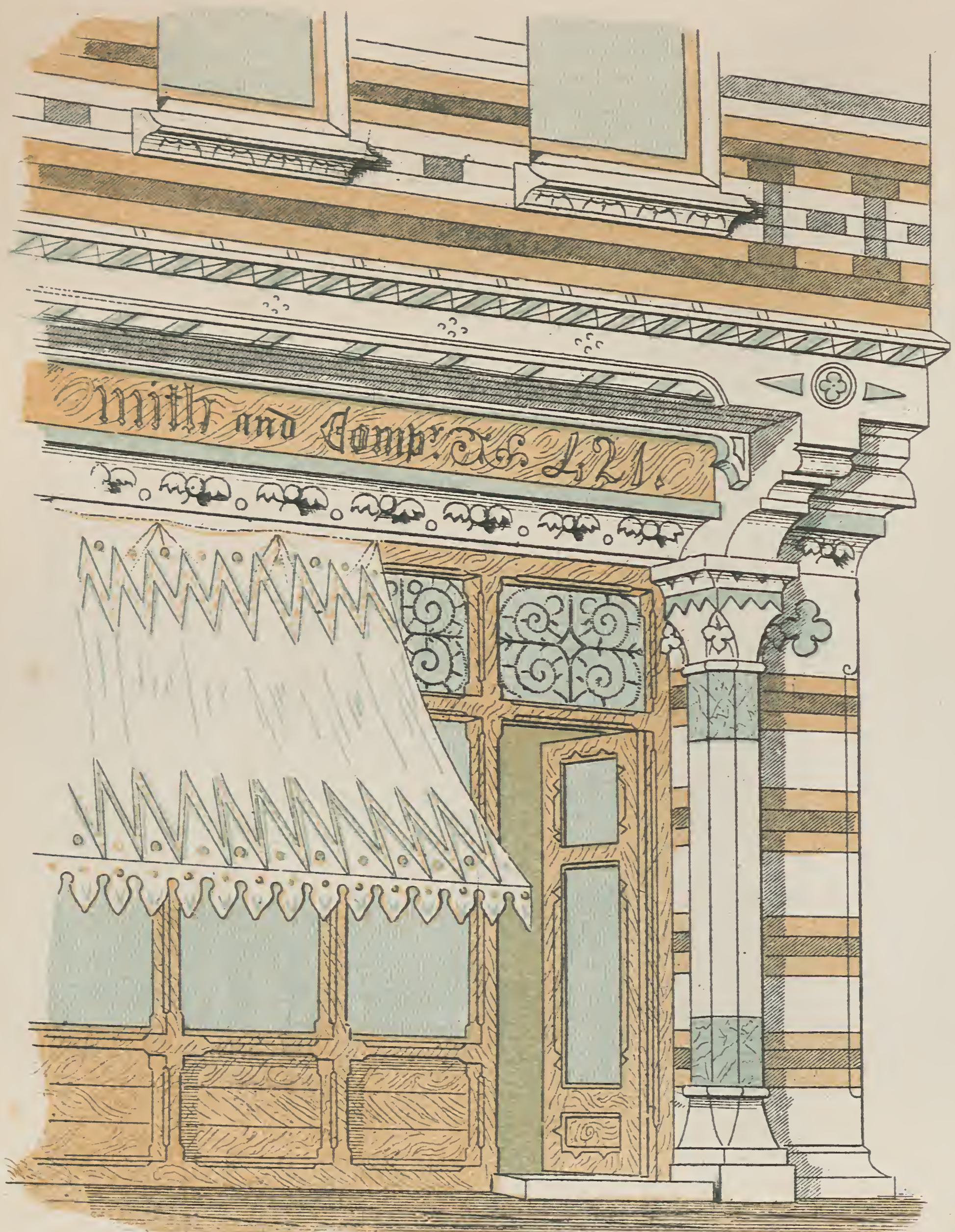


Fig. 1.

Fig. 2.

Scale of 0 1 2 3 4 5 10 Feet.

partitions, are the preferable methods. It should be observed that walls intended to be painted are generally finished with what is called *trowelled stucco,* which is worked on a floated ground, the floating being left till nearly dry before the stucco, beaten and tempered to a thin paste, is laid on. Walls, &c , intended to be papered, are usually finished with a stucco, containing a less proportion of sand than in the former case; and it is merely spread very thinly indeed upon the floated work, and polished with water and the trowel.

ORNAMENTAL PLASTERING, as distinguished from the more simple processes here mentioned, embraces the modelling, casting, and fixing all the ornamental and decorative features in building, executed in plaster. These are usually cast in pure plaster of Paris, in wax or gelatine moulds, taken from the original clay model. Sometimes the castings are taken from plaster moulds. The first is generally used in the case of the smaller ornaments and enriched mouldings, &c., and the latter in works of larger dimensions. The process in the moulding is in both cases briefly as follows:—

To obtain the wax mould, the clay model must be first well oiled with sweet oil. It must then be enclosed within a boundary of clay, to secure the liquid wax from spreading beyond a certain distance. A sufficient quantity of wax and rosin is next dissolved together, and poured lukewarm, or in such a state as to run freely, all over the model, so as to fill every part. The wax being well set, the whole must be placed in water, which will cause the wax to relieve itself from the clay the more readily. Then the wax mould, being carefully cleansed from any remaining portions of the clay, will be ready for casting from.

The process of moulding in plaster is similar: the clay model is first, as in the other case, to be well saturated with oil, after which the plaster must be laid on by portions at a time, and not in too liquid a state, the junctions being carefully formed and fitted to each other as respects position, according to the convenience of after separation. When the model is entirely covered with these portions or pieces, and they have become sufficiently set, the same are removed, thoroughly dried and cleansed, and then soaked in boiled linseed oil. When again quite dry, they are ready for use, and being oiled with sweet oil, like the wax mould, may be cast from in the same manner.

The casting is a comparatively simple proceeding. Plaster of Paris, mixed with water to a half fluid state, is poured in sufficient quantity into the mould, and stirred as may be necessary to cause it to fill every part; the same, after remaining a short time, being floated off with a brush flush with the rim of the mould. Time being allowed for the plaster of Paris to set, the castings are taken from the mould, cleaned off, and made ready for fixing.

The smaller ornaments and enrichments thus produced are fixed with putty, well gauged with plaster in recesses left for them in the run portion of cornices and other work. In fixing large ceiling flowers or heavy work, it is necessary to prepare in other ways, such as guaging in fine stuff from the lathing, forming a key thereon for the same, and fixing the ornament thereto with fine stuff, assisted, as may be sometimes necessary, with screws.

In the case of ceilings formed into caissons or deep panels and compartments, such as exhibited in *Plates* 83 and 84, the necessary skeleton formation, or bracketing for the main divisions, is provided and fixed by the carpenter.

Gypsum, or *sulphate of lime*, is the basis of plaster,—that called *Plaster of Paris*, from Montmartre in the neighbourhood of the city, being probably the best. Chalk lime, mixed with other ingredients, is used for common work. The various stuccoes are composed of lime, plaster, calcareous powder, chalk, &c. *Bastard* stucco is the more common, and is left rough from the *hand-float*, and generally coloured ; while *trowelled* is smoothed, and usually painted or polished. *Scagliola*, a peculiar species of plastering, invented in Italy, and imitative of different coloured marbles, is expensive but very effective. Of what are called "artificial plasters" or "cements," Parian (like the marble of that name), Keen's, John's, and Martin's, may be named as in extensive use. Parker's, or Roman cement, is chiefly used for external work, and is an excellent material : Portland, however, should always be preferred.

The above are the principal practical points for consideration in relation to the execution of plaster-work. We will now offer a remark or two with reference to the æsthetic propriety of its use, and the question of advantages. The former, considered as a decorative finish to buildings, has of late years been largely discussed. Its adoption, externally, has been especially censured, as tending to increase the present obvious want of architectural truth, honesty and genuineness, on which the modern mediæval school of architects so strongly insist. Certainly, the facing of Gothic structures with what, in this mode of its application, is wrongly called "cement," is almost always productive of a wretchedly poverty-stricken effect. But the fitness of the use of the material in the Italian style of architecture, is far less open to doubt, however, in the repetition of forms only suitable to stone-work, architects may have hitherto failed in devising such as are peculiarly adapted to plaster. Again, there can be little question that, in many instances, external plastering is decidedly conducive to the preservation of buildings from the decay induced by damp in this changeable climate, as well as to the retention of warmth.

With respect to the internal use of plaster as a finishing to the bare walls of rooms, conducing to comfort and gratifying the eye, the undoubted property of the material, as commonly used, to absorb and retain moisture, is the most obvious objection. When a room is left for some time without artificial warmth, and a fire is lighted, the imbibed dampness is liable to be given out, and thus injure the health of the inmates. Not merely is there this objection, but, of course, the durability, first of the wood-work behind the plaster, and next of the structure itself, is affected. The evil is increased by papering, as it also is absorbent; and the size used in its manufacture, the glue, and the paste particularly, are all more or less deleterious. Painting, however, hardening the surface of the plaster, prevents absorption; and the further advantage is afforded that the surface can be periodically washed.

A large unbroken surface of painted plaster is not, however, generally agreeable to the sight; though it has been, and still is to some extent, the fashion, as applied to the walls of rooms. Such being felt, relief has been sought in the introduction of gilt mouldings separating the surface into panels, and various corresponding admission of colour. The effect produced by these has also been imitated in various applications of paper—the objection to the whole being, that they are simply imitations, and not the real panelled arrangements and broken surfaces they pretend to be. The old wainscotted rooms and relieved decorations in plaster

WALL DECORATION—CLASSIC.

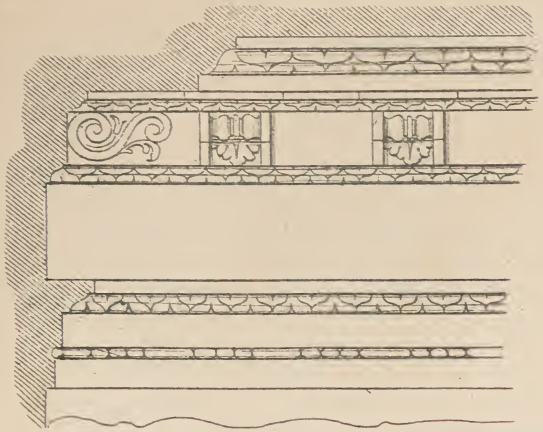


Fig. 2.

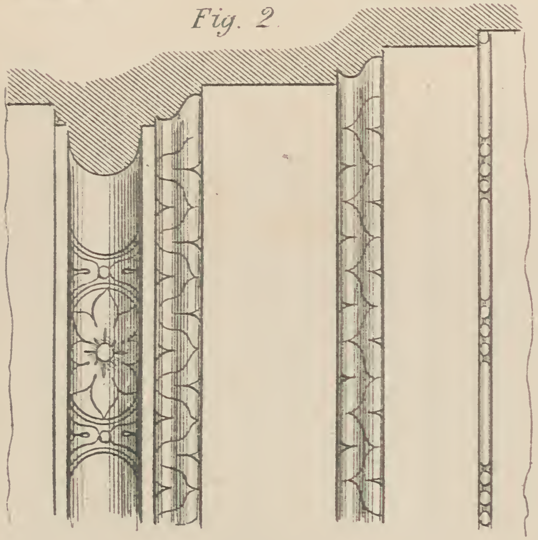


Fig. 3.

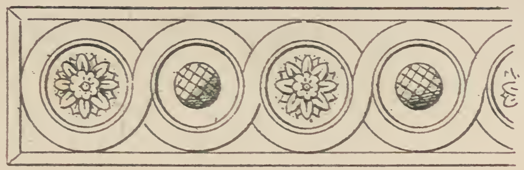


Fig. 4.

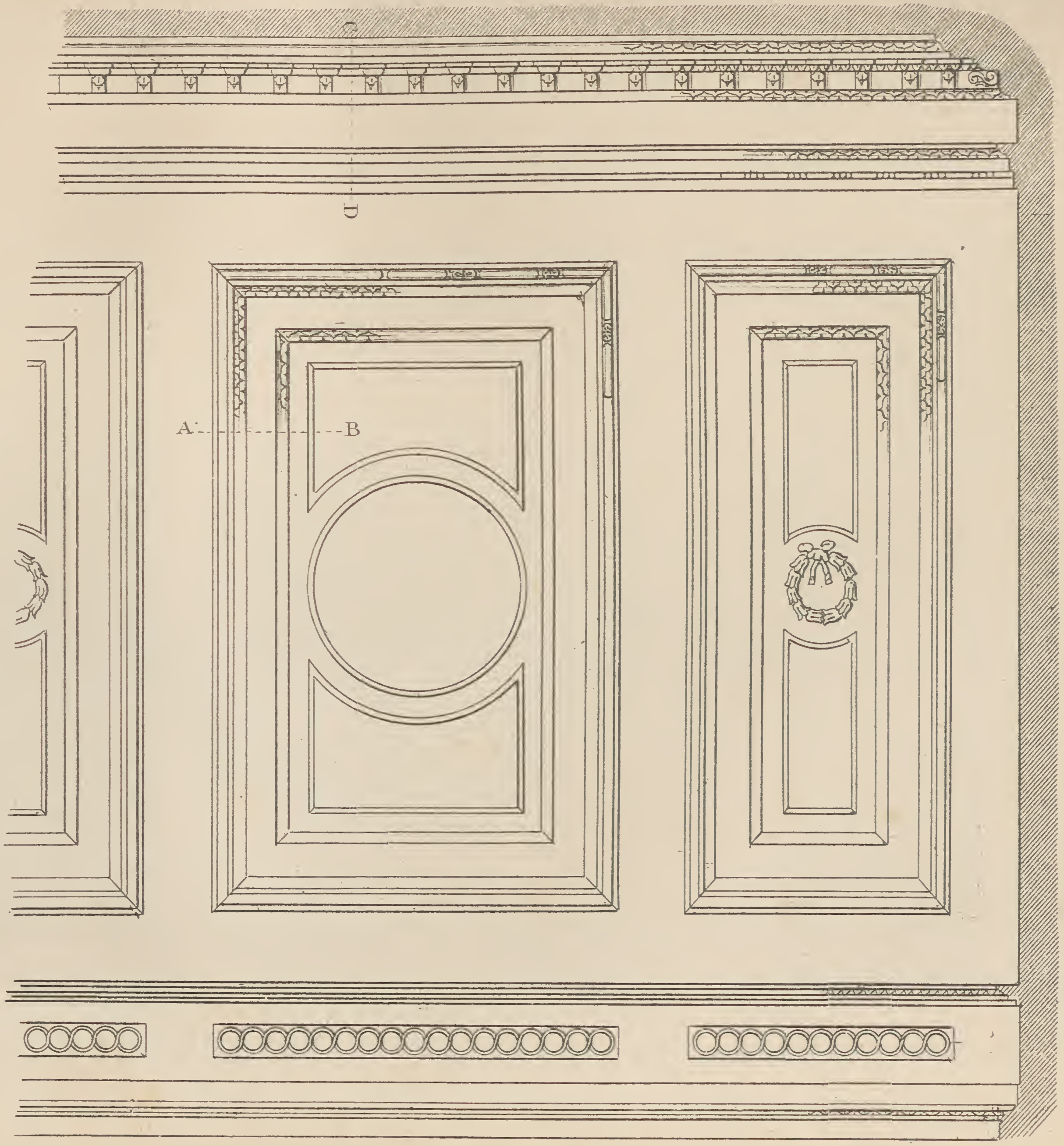


Fig. 1.

PANEL-DECORATION.

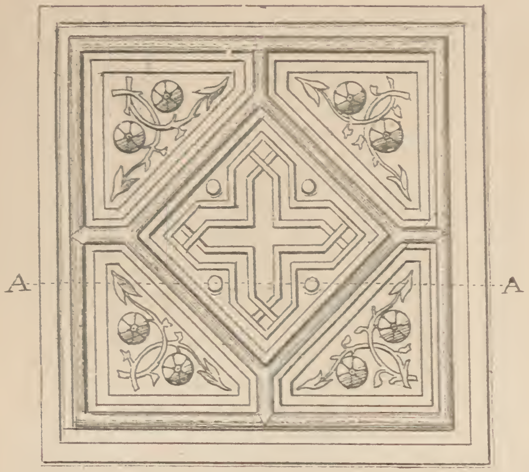


Fig. 6.

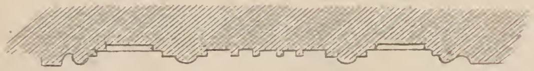


Fig. 7.

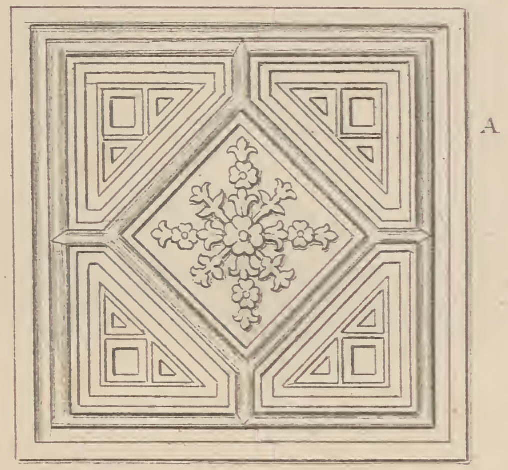


Fig. 5.

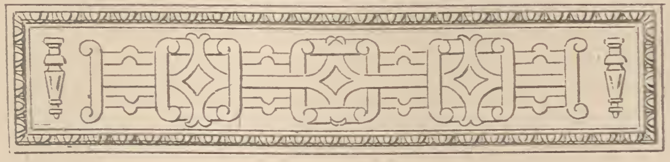


Fig. 2.

Fig. 1.

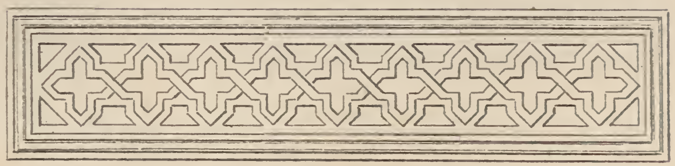


Fig. 3.

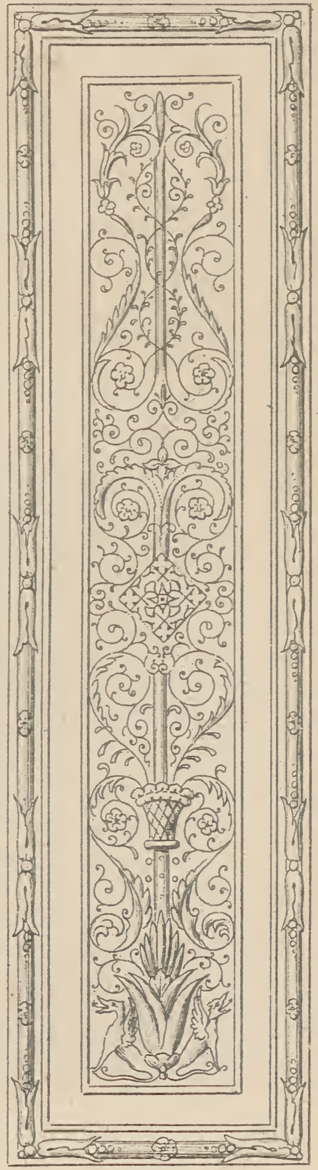


Fig. 4.

and composition of the last century were far more satisfactory, as expressing genuineness at least; and there appears no good reason why a return to the same principle as respects wall decoration in plaster should not be indulged in—at all events to an extent applicable to modern wants and received notions in style. Walls enriched in plaster-work might be made very effective and pleasing; and the medium affords opportunity for extensive and elaborate enrichment, where such might be desired: witness the character of the enrichments of this kind in Moorish architecture, and the somewhat similar mastic compositions applied to stone-work and wood-work in mediæval times as relieved ornament to plain surfaces. In the case of ceilings, the admission in this way of plaster ornament is, as we have hereafter remarked, abundantly recognised; while to the purposes of wall decoration, under proper restriction and treatment, it might be equally subservient and useful; and here the disadvantages above alluded to can the more readily than in the latter case be provided against. Under this impression the designs for wall and panel decoration exhibited in *Plates* 77 and 78, and 79 and 80, are submitted as suggestions.

In the first, or *Plate* 77 and 78, we give a design for panelled arrangements as a finishing to walls in the Classic style. The parts most exposed to injury from contact with furniture, &c., might be executed in the harder cements, such as Keen's, &c., and polished, the mouldings being picked out in colour and gilding. Scagliola might be introduced as grounds for the panels, the frieze, and the die of the dado, with good effect.

Fig. 1, shews, as will be seen, a portion of the side of a room with its dado, architrave, frieze and cornice, and intermediate panelling.

Fig. 2, is an enlarged section of the entablature taken at C D on the elevation.

Fig. 3, a like enlarged section of the panel mouldings taken at A B; and

Fig. 4, an enlarged elevation of the ornament in the die of the dado.

In *Plate* 79 and 80 several varieties of panel and other plaster enrichment are shown.

Fig. 1, exhibits two designs for a circular centre to panelling, applicable to either ceilings or walls. In the latter case the centre part, containing the superior enrichment, should be deeply recessed for protection, and it would be better executed in some of the harder compositions. As a ceiling panel, it might project agreeably with the vertical section shewn on its left.

Figs. 2 and 3 are frieze enrichments of Elizabethan character. A vertical section shewing their relief is given in connection with each.

Fig. 4, is a pilaster or upright panel ornament of what is called the Arabesque description.

Figs. 5 and 6, are two designs for the enrichment of square panels

Fig. 7, being a horizontal section of the latter, taken on the line A A, shewing its relief.

To all the above, colour and gilding might with strict propriety be applied.

With respect to the use of plaster for ceilings, modern practice has so associated the application with present notions that it would be difficult not to deal with the consideration of it in this particular case. It would be better, doubtless, in many instances, to leave the timbers visible, after the old fashion, and mould or chamfer, and then paint or stain them,

than to lath and cover them with a plain surface of plaster, the naked and bare effect of which is obvious, and suitable only, if at all, in the most common descriptions of building.

In richly decorated ceilings, however, plaster has the advantage, that the moulded work and enrichments are less costly than the execution of such would be by carving and hand labour. It should be borne in mind, however, in the design of these, that the old constructive arrangements in timber and stone, and the decorations applied to them, constituted the models from which the plaster was taken. The girders and binders of floors originally formed in reality the separations between the compartments or panels in flat ceilings, and the caissons in coves and domes, &c.; and reference to this should regulate proceeding in the case of plaster-work applied in imitation. Cornices, under usual circumstances, in ordinary rooms should be light, extending rather along the ceiling than down the walls, as giving the effect of increased height. If columns or pilasters are introduced attached to the walls, the received proportions according to the order should be adhered to; and if an entablature is adopted without columns or pilasters, its height will be in good proportion, if from one seventh to one ninth that of the room. Plain large cornices may be from one fourteenth to one twenty-fourth. In coved ceilings the cove may be from one fourth to one sixth of the height. Where beams are used, the sides should be finished with mouldings against the ceiling, and the under surface may either be plain or have recessed enrichments.

With reference to the above observations, we give in *Plates* 81, 82, 83 and 84, three or four varieties in design for ceilings executed in a plaster medium. The first, or *Plate* 81, represents a design for a dining-room ceiling of Elizabethan character, which may be formed entirely in plaster, or partly in papier-maché, carton pierre, or other similar composed material; the former being used for the plain surfaces of the panelled portions, and for the ribs, and such of the moulded work as is run; and the latter for the central ornaments and other parts proposed to be in relief. The addition of colour and gilding can of course be applied when desired in each case. The plate, which shows rather more than one fourth of the ceiling, will be sufficiently explanatory of the general idea, and the positions of the enrichments. With respect to the detail, we give in the annexed cut, *Fig.* 1, a section through the ribs one-third of the actual size. The amount of moulding in these may of course be varied according to taste, or the extent of the enrichment in other parts of the ceilings. In *Fig.* 2, we give the hanging pendant which forms the ornament of the circles at the angles of the main central panel or compartment,—the one half showing the same as elevation, and the other half a vertical cut through the moulding; and in *Fig.* 3, we give a like sectional profile and elevation of the pendant of the central flower or ornament of the ceiling — both to the same scale of one-third the actual size. Both of these, like the ribs, are open to a greater or less amount of decoration as respects moulding or other work, according as the ceiling professes to be of a more or less rich kind, and to them colour may be in the same manner also applied

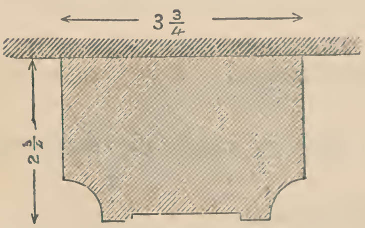
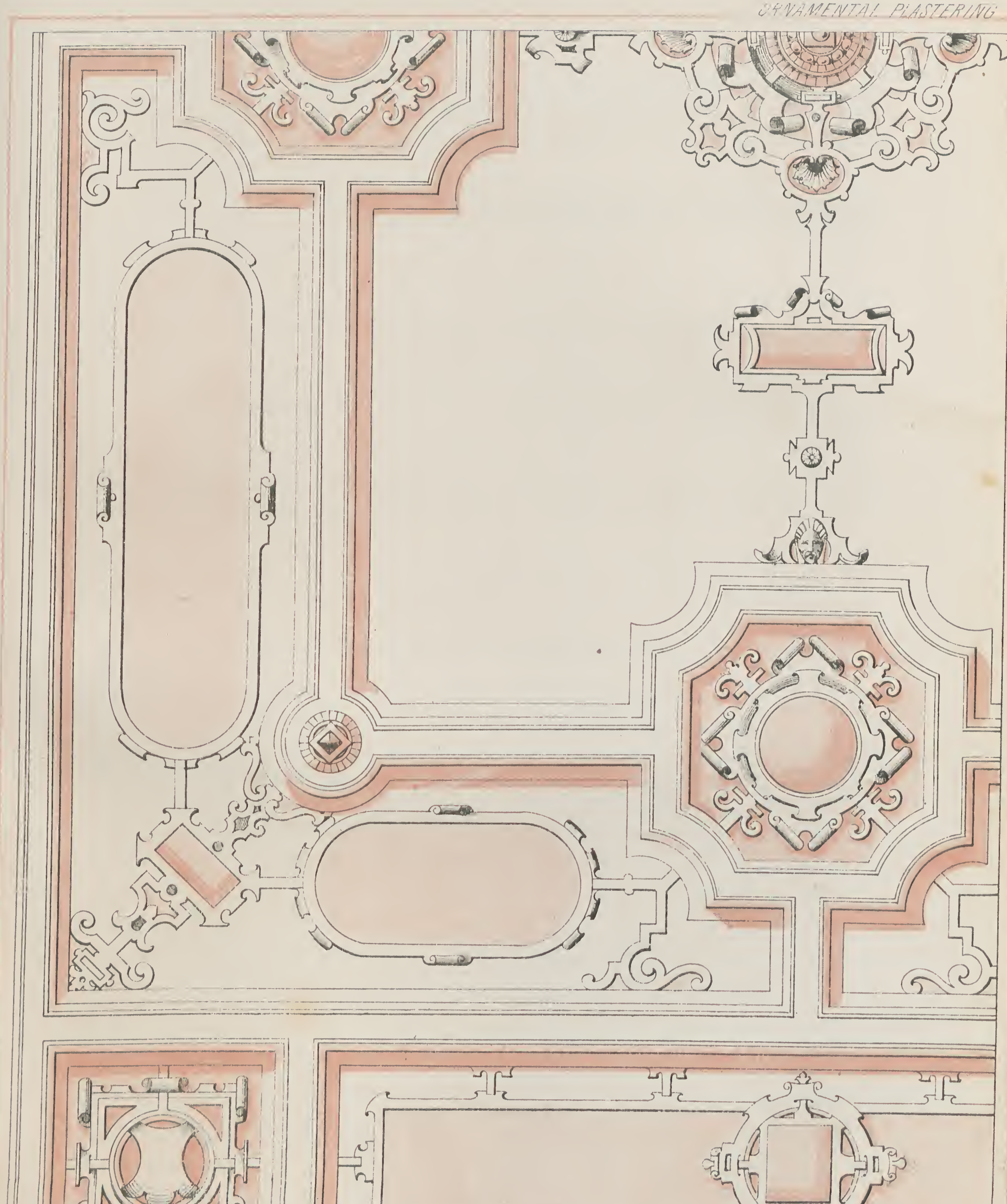


Fig. 1.

DESIGN FOR A CEILING

ORNAMENTAL PLASTERING



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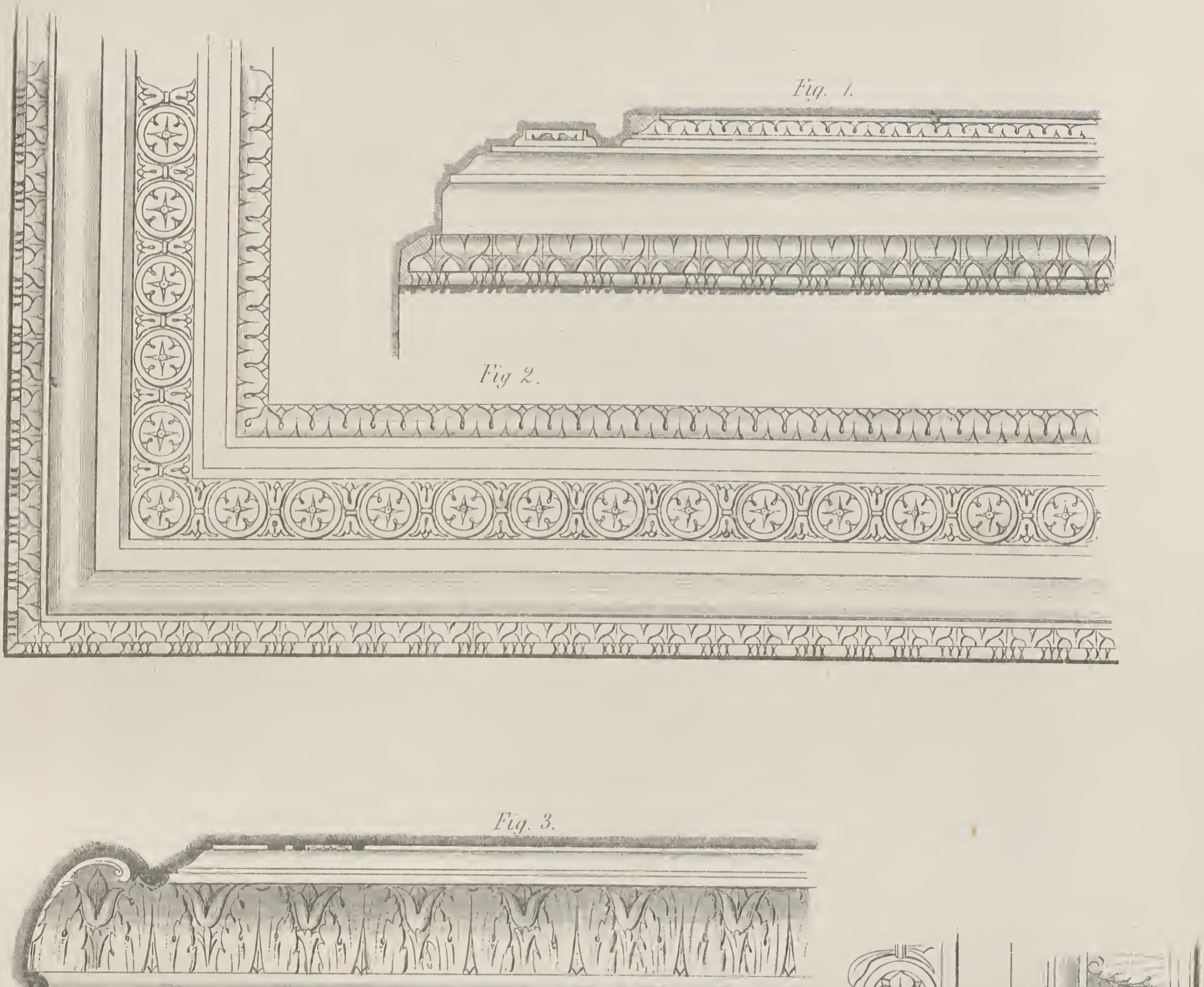

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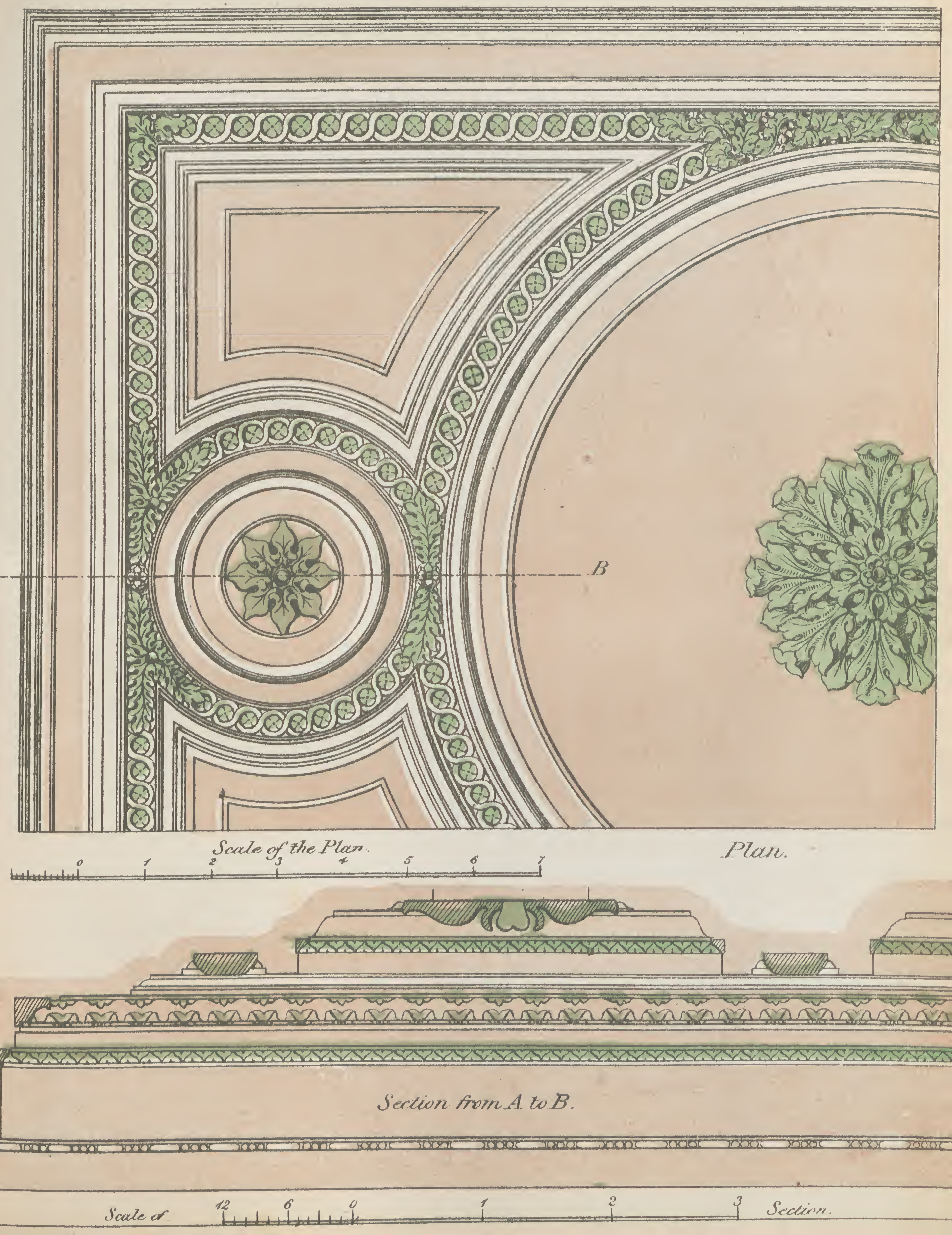
B
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Plan.
Section from A to B.
Scale of
12 6 0 1 2 3
Section.

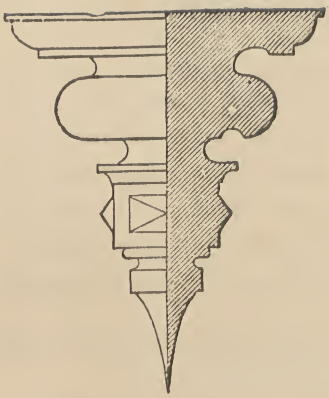

Fig. 2.

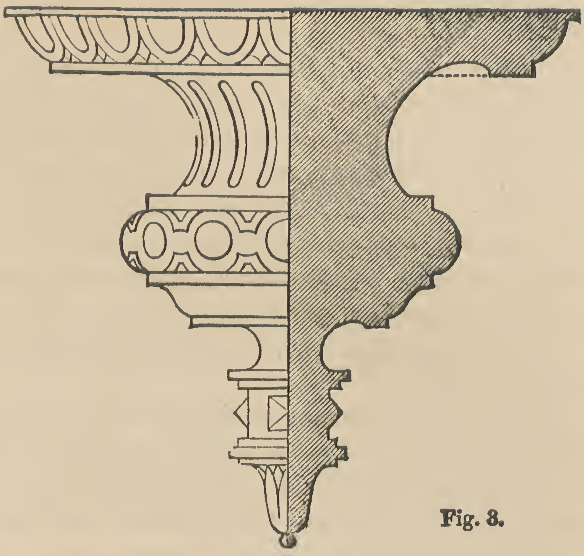

Fig. 3.

where desired. Speaking of this as an additional or relieving enrichment to the moulded and raised portions, it may be observed that in the semi-circular ended panels left blank in the plate, arabesques in character with the style might be introduced advantageously, and with considerable effect. Within the circular centres of the cartouches in the four panels surrounding the centre flower, initial cyphers or heraldic devices might with propriety be painted, as they might also on the shields in the four angle panels, and those in the centre of the long panels at either end. In these latter, mottoes, or poetic couplets, or sentences in gold and coloured letters would be appropriate in rich work. The grounds for these kinds of enrichment should be deep positive colours,—the heraldic rule of metal upon colour, and colour upon metal, being regarded in all cases. The general colouring of the composition should harmonise with that which prevails in the apartment of which the ceiling forms part.

In *Plate* 82, are two designs for ceilings, in which the ornamentation is confined to the cornice and to that portion of the flat of the ceiling immediately against it. These are suitable for moderately sized rooms, and would have a very pleasant effect. The upper figure on the plate is more strictly, perhaps, a cornice only, than the one in the lower part, since it has no bounding or enclosing enrichment on the surface of the ceiling beyond the cornice proper, as the latter has. As will be seen,

Fig. 1, shews a section through the moulding, and an elevation of part of the cornice, with its enrichments ; and

Fig. 2, the plan or soffit, as viewed from below.

Fig. 3, is a section of the second mentioned design, shewing the sweep of the cove, and the mouldings on the wall and ceiling.

Fig. 4, is the corresponding plan or view of the soffit, with the enclosing enrichment on the flat of the ceiling, viewed from below.

Plate 83, shews a design for a more elaborate ceiling, the surface being ornamented by division into superior and inferior panelled compartments, enriched with floral and other decoration. The general division, as will be seen, is by main beams or separations into three, or a larger central square, and two oblong end spaces; the plafond, or surface of the latter, being left plain, while the centre is enriched by subdivision and other additional ornamentation. The nature of this is fully shewn in the plate, to which we therefore immediately refer the reader, observing only that, being designed for a position at no great distance from the eye, neatness and precision, rather than boldness, are desirable in the character of the enrichments.

Fig. 1, as will be seen, is a plan of the entire ceiling, with its various enrichments, as seen from beneath.

Fig. 2, is a transverse section from C to D on the plan, shewing the side of the main beam next the central compartment, with its supporting brackets in elevation; and

Fig. 3, a longitudinal section on the line A B on the plan, shewing the different recession of the larger and the two smaller end compartments, with the moulding of the same and of the main beams; the front faces of two of the brackets being seen in elevation.

This ceiling is particularly suited to the introduction of colour and gilding, and painted ornament, which, if judiciously introduced, would add much to the richness and pleasure of its effect.

Plate 84, is a design for a somewhat similar ceiling, which has been treated with reference to a moderate admission of this latter description of aid, and which is of course capable of increase as well as variation to almost any extent.

The general arrangement, as will be observed, is that of a main central circle, containing in the midst a large relieved flower—which may be composed either of plaster or composition—a smaller circle and angle compartments at each end, the whole surrounded with an ornamented band, making up the length of the room. In the upper figure in the plate rather more than one fourth part of the plan of the ceiling is shewn, the general surface being tinted of a pale pink, the relieved ornaments and mouldings being coloured green; which might be lightened with gilding on the fillets, fibres, edges, &c.

The lower figure represents a section of the portion included within the line A B on the plan, given to an enlarged scale, for the purpose of shewing more clearly the moulding, and the nature and depth of the recessed parts.

CHAPTER XXIV.

ON DECORATION.

Decoration, on which we have to make a few observations, and to offer an illustration or two in conclusion, will be here more particularly viewed with reference to the applications

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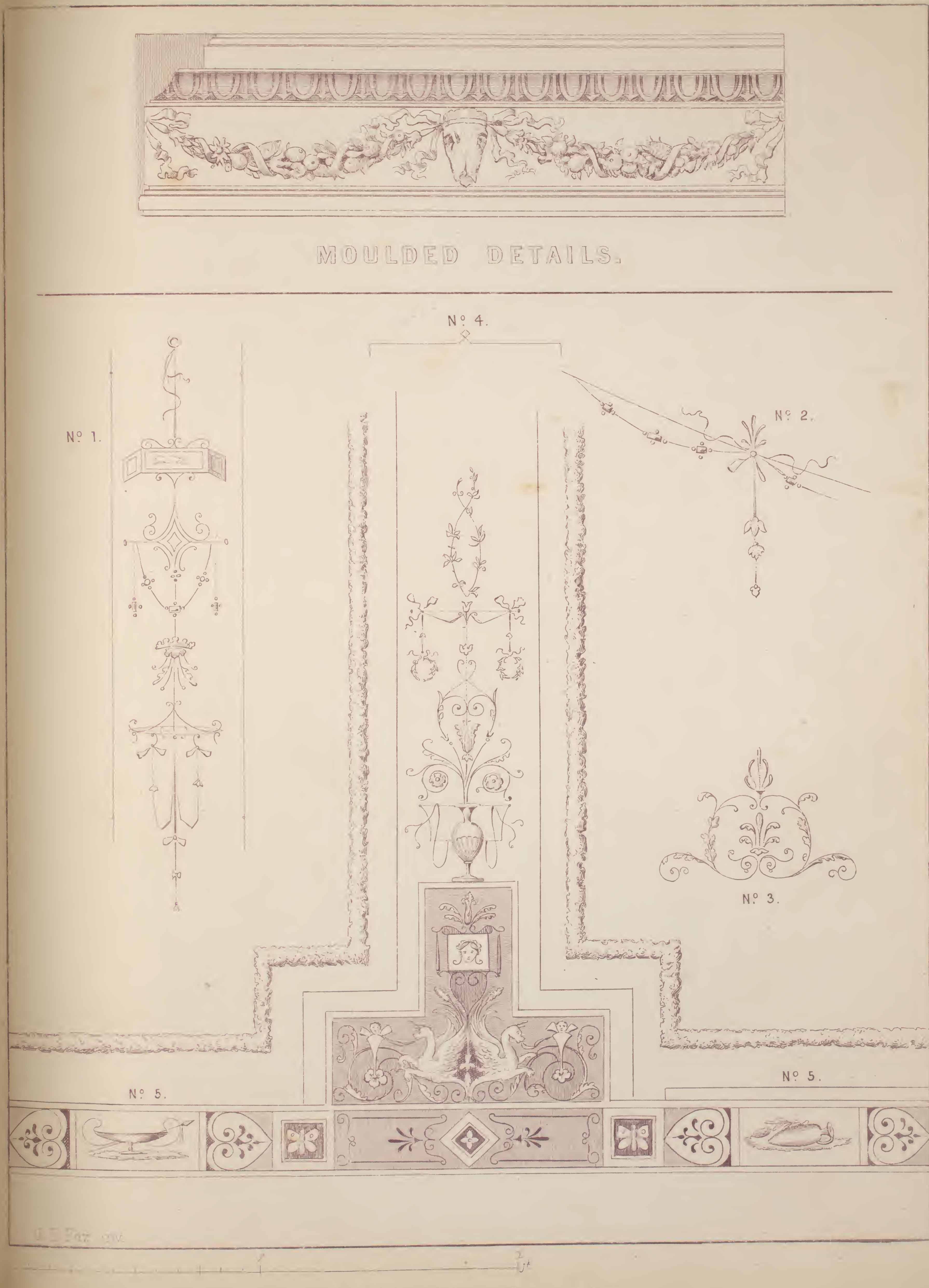


London: James Hagger, Paternoster Row

of colourea ornamentation to plain and relieved surfaces; similar, as respects the latter, to those remarked upon under the head of Surface Ornament.

Among the ancient Greeks and Romans this species of enrichment was extensively employed; among the former as well on the exterior as interior of their buildings; and many remains have descended to us, shewing the capabilities of such introductions, under the restrictions which, in their best days, regulated the taste of both peoples. It would lead us too far into the subject were we to attempt entering into a history of the progress, or description of all the various exhibitions of the practice with either. It will be sufficient for our purpose to refer to the fact of its existence, and accept it as the authority for all subsequent admissions of the same kind.

The most usual forms in which coloured decorations are introduced at the present day is that of an additional enrichment to mouldings and other carved or relieved work in ceilings, cornices, and panelling, intermixed with gilding. In some cases, painting of a more strictly artistic kind is employed in ceilings and walls, after a fashion prevalent not very long since, and still to be seen at Hampton Court and in the houses of our nobility and gentry of the same age. Panel paintings are also occasionally seen in the style, both as respects subject and treatment, for which Watteau was famed. Generally speaking, however, these have given way to plain flat tints upon the larger surfaces in both cases, sometimes relieved by borders of colour, and sometimes, as previously noticed, by relieved mouldings and ornaments in gold, arranged as bordering lines to spaces more or less large.

Of a somewhat similar treatment and arrangement to this, there are many examples in classic antiquity, both in the more simple as well as in the more elaborate shape. Some very pleasing forms of wall decoration are to be found in Pompeian examples, from which our continental neighbours have drawn largely, and in many cases with good effect and taste. As a specimen of the Italian Renaissance from this source, we would refer to the design so entitled in *Plates* 85 and 86, where the panelled arrangements of the wall surface, to which we have before once or twice alluded, are produced by colour alone, as is likewise all the other decoration, the mouldings of the cornice and dado excepted.

Used as the decoration of a drawing-room, this design should be executed in dull and low, though warm tints of purple, violet, yellow, or green, in order to form good back-grounds for pictures, engravings, and other works of art which may be placed against them. The portions forming the separation between the panels, the pilasters or styles, as they may be called, and the head above them, should be lighter than the panels, and even of a different tint, for more varied and contrasting effect. The ground of the border immediately above the dado, with that of the small panels painted thereon, should be in dark and rich, but not bright tones; the more vivid colours being reserved for the arabesques and the fillings in, indicated by the lighter colour in this portion of the plate. The darker parts of the small squares in the border might be tinted in full and bright colours. The subjects of the central or oblong panels in the border, numbered 5, 5, in *Plate* 86, with those at the foot of the pilasters, should be brilliantly painted in their proper or natural colours, they forming the principal objects in the composition at this part.

In the treatment of the dado, the chief care should be to give to it a lower and deeper tone of colouring than that applied to the walls; and if imitations of the darker marbles be here introduced, they would strengthen the general effect by the variety and warmth of their veining. The colouring of the frieze and cornice should be lighter and brighter than that of the general wall surface, and the smaller mouldings might be picked out in gold, though gilding should be but sparingly used. The fine lines within the large panels should be drawn in darker but corresponding tint to the panels; the arabesques, or the pilasters, and the head above, in their proper colours, as should the wreaths, &c., in the frieze. White, with the horns gilt, would be best for the ox heads. On referring to *Plate* 86, as will be seen, the details here mentioned, with that of other parts of *Plate* 85, are given to an increased scale. The figure

No. 1, shewing the pendant ornamentation at the upper part of the pilasters;

No. 2, the festoon and pendant, strings of jewels, &c., above the head or top of the panels;

No. 3, the central ornament of this festoon.

No. 4, shews the arabesque enrichments at the foot of the pilasters in connection with those above the surface of the dado, and a different form of border to the large wall panels; and

Nos. 5, 5, the painted subjects before noticed as occupying the small central oblong panels beneath the latter.

It will be noticed that in the small square panels adjacent to the last mentioned, against the arabesque at the pilaster foot, are painted butterflies—these, of course, would be executed in vivid natural colours, as might be also the animal figures in the arabesque itself.

Our next plate, 86*a*, shews similar applications of coloured decoration to a staircase of Roman character, in which coloured marbles are also introduced. In *Fig.* 1, these latter are shewn as enriching the dado and the parapet or enclosing wall of the stairs, which, in contra-distinction to that of *Fig.* 2, which is a balustrade, is here represented solid. Coloured marble also here alternates with plain stone, in the lower wall surface; while, on that of *Fig.* 2, a pattern is intended to be merely painted. The fret beneath the cornice of the landing, &c., is also proposed to be painted, and the wreaths on the friezes, and raking-string of the stair in both cases, may be similarly treated; or they might be carved, and heightened with colour.

The enrichments of the upper wall surface would, of course, be in painting, the ovals being filled with pictured subjects. The borders to these, if in relief, should be picked out in gold. The foliage and flowers of the festoons should be in their natural colours; the connecting ribbons in full dead colour, harmonious, yet of contrasting nature with that chosen for the general ground. The cornices in connection with these wall surfaces, and the ceiling above, should be enriched with colour and painting, to correspond. It is unnecessary to mention that in very rich works the same may be introduced, to greater or lesser extent, into all the other architectural features of the staircase.

WALL DECORATION.—ROMAN.

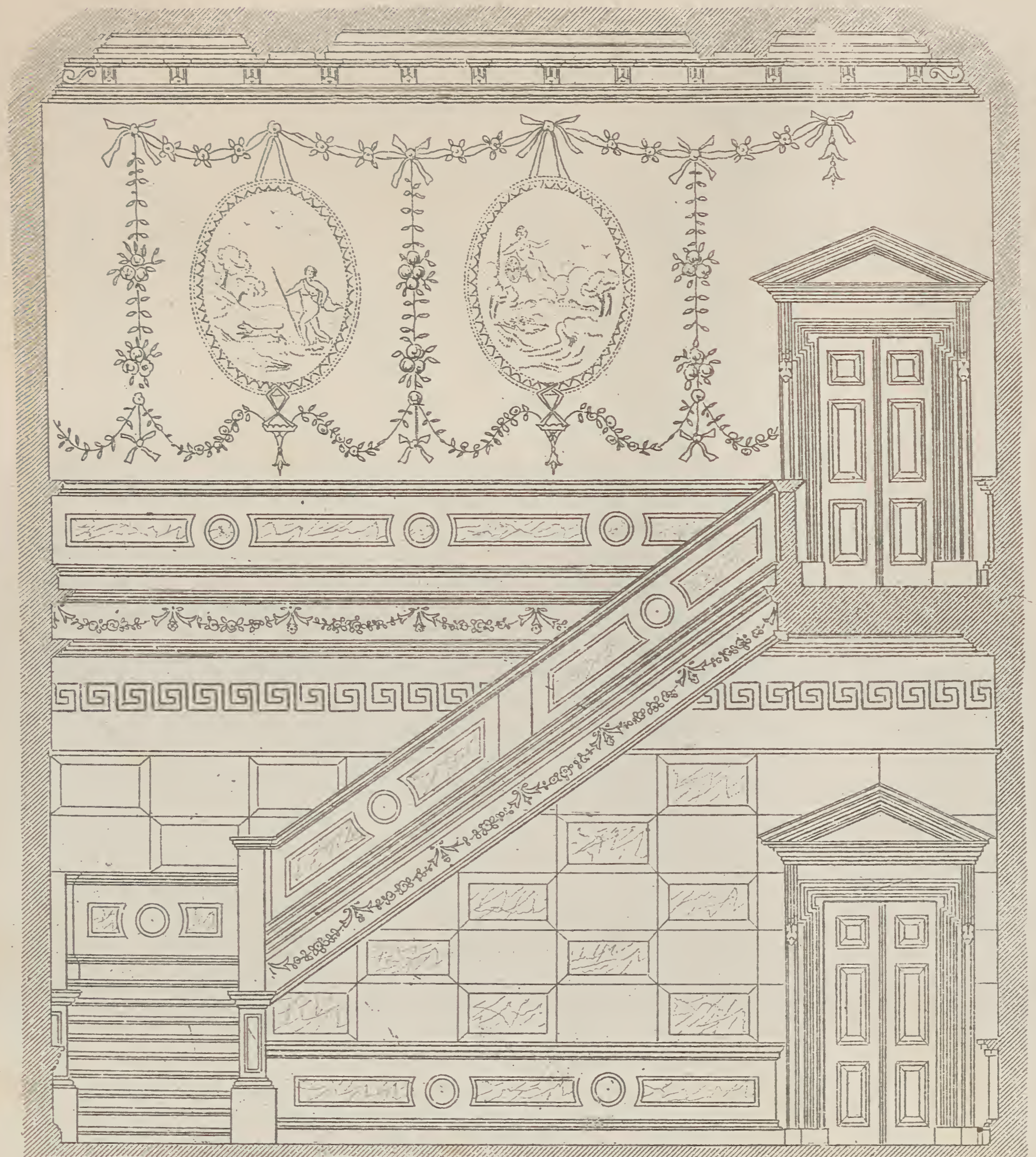


Fig. 1.

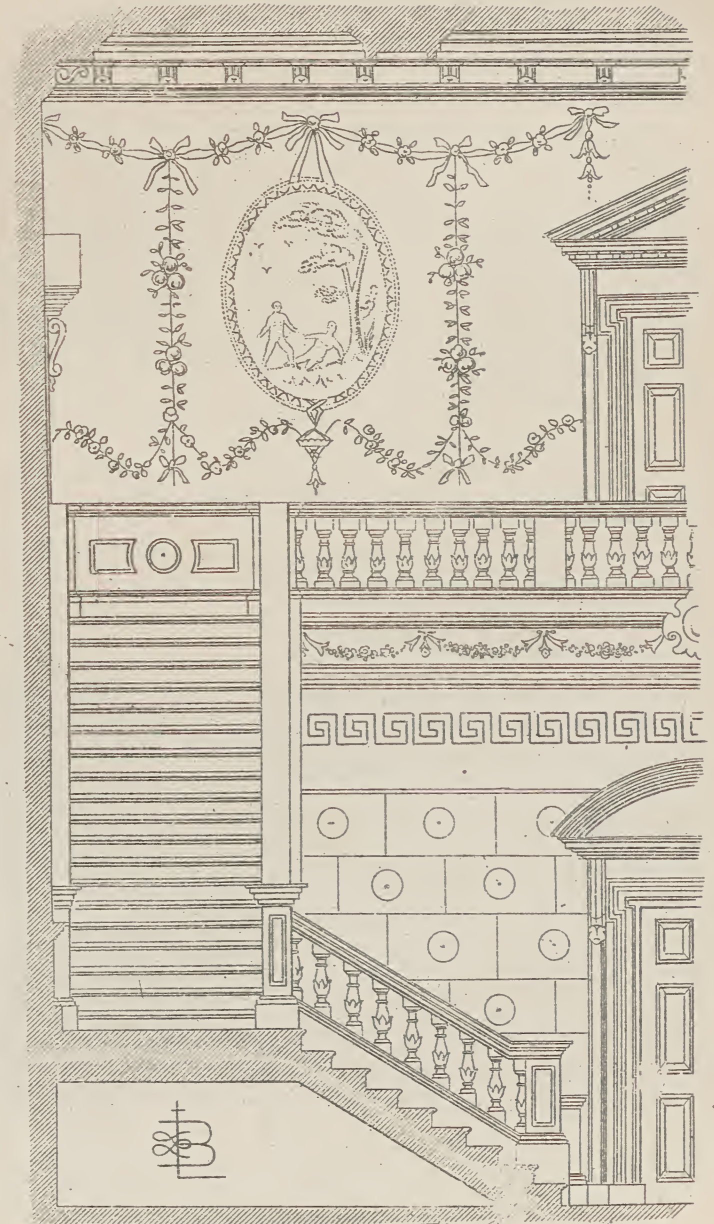


Fig. 2.

Scale of 5 10 20 Feet.

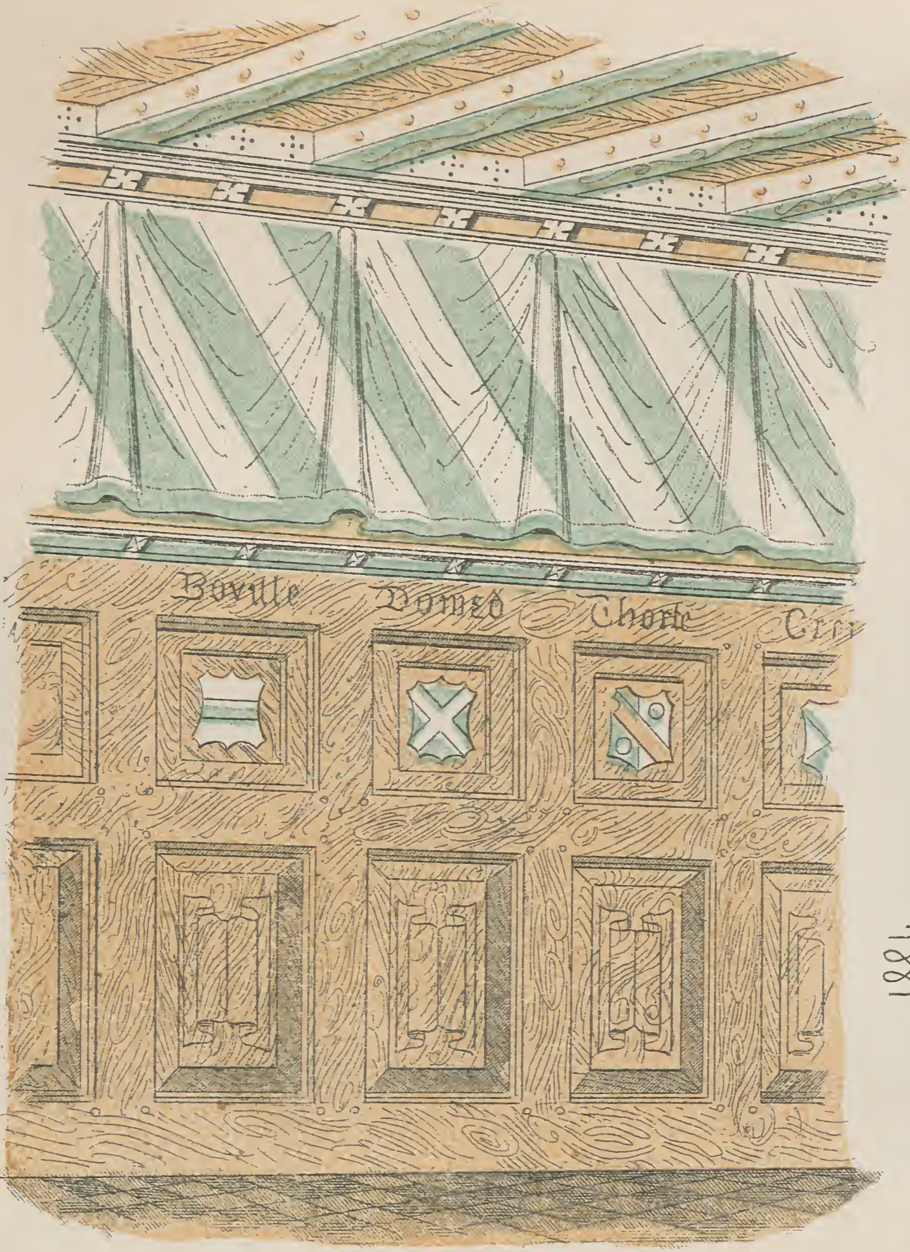


Fig. 1.

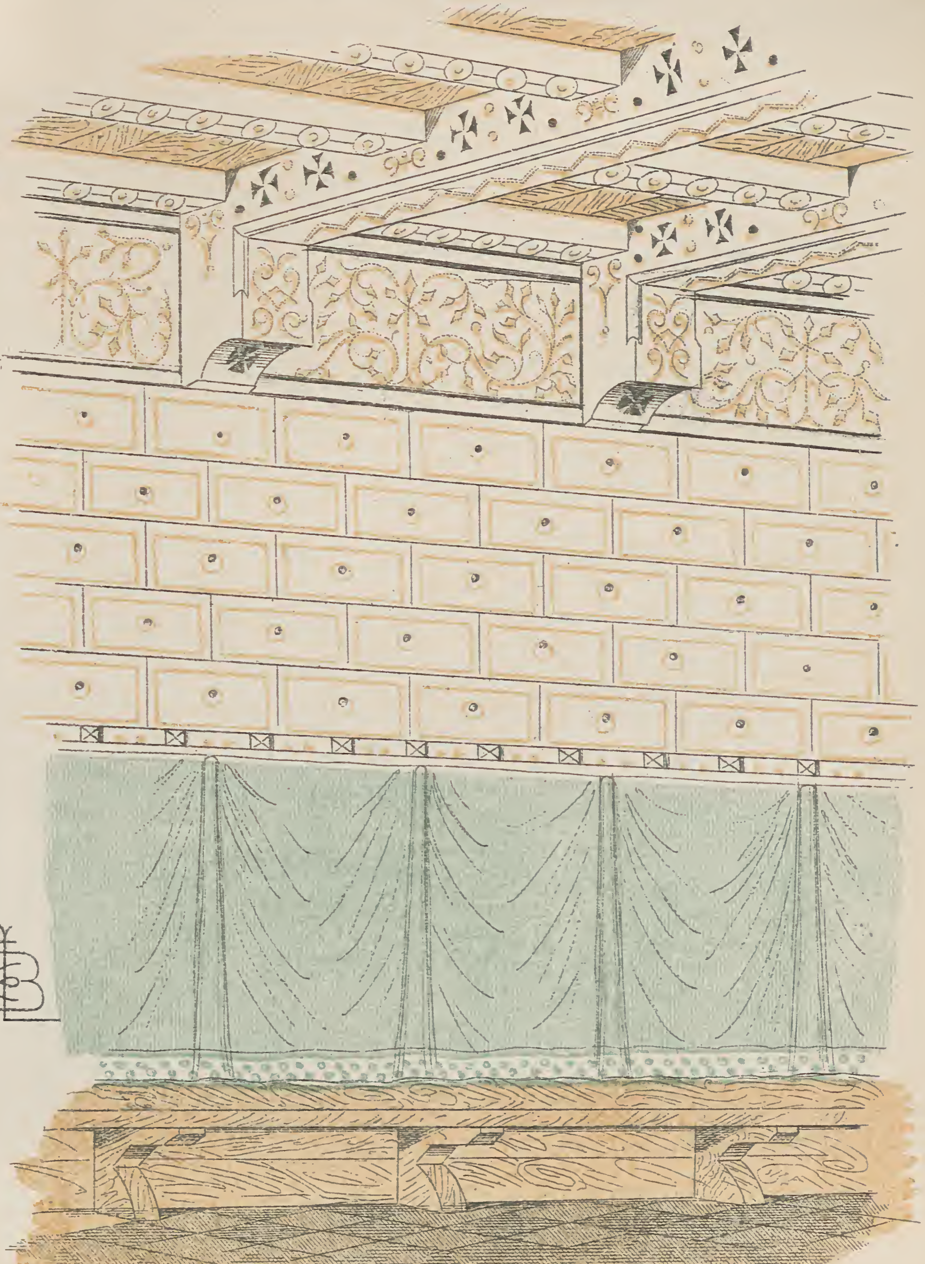


Fig. 2.

Scale of 1 2 3 4 5 10 Feet.

WALL DECORATION. ELIZABETHAN.

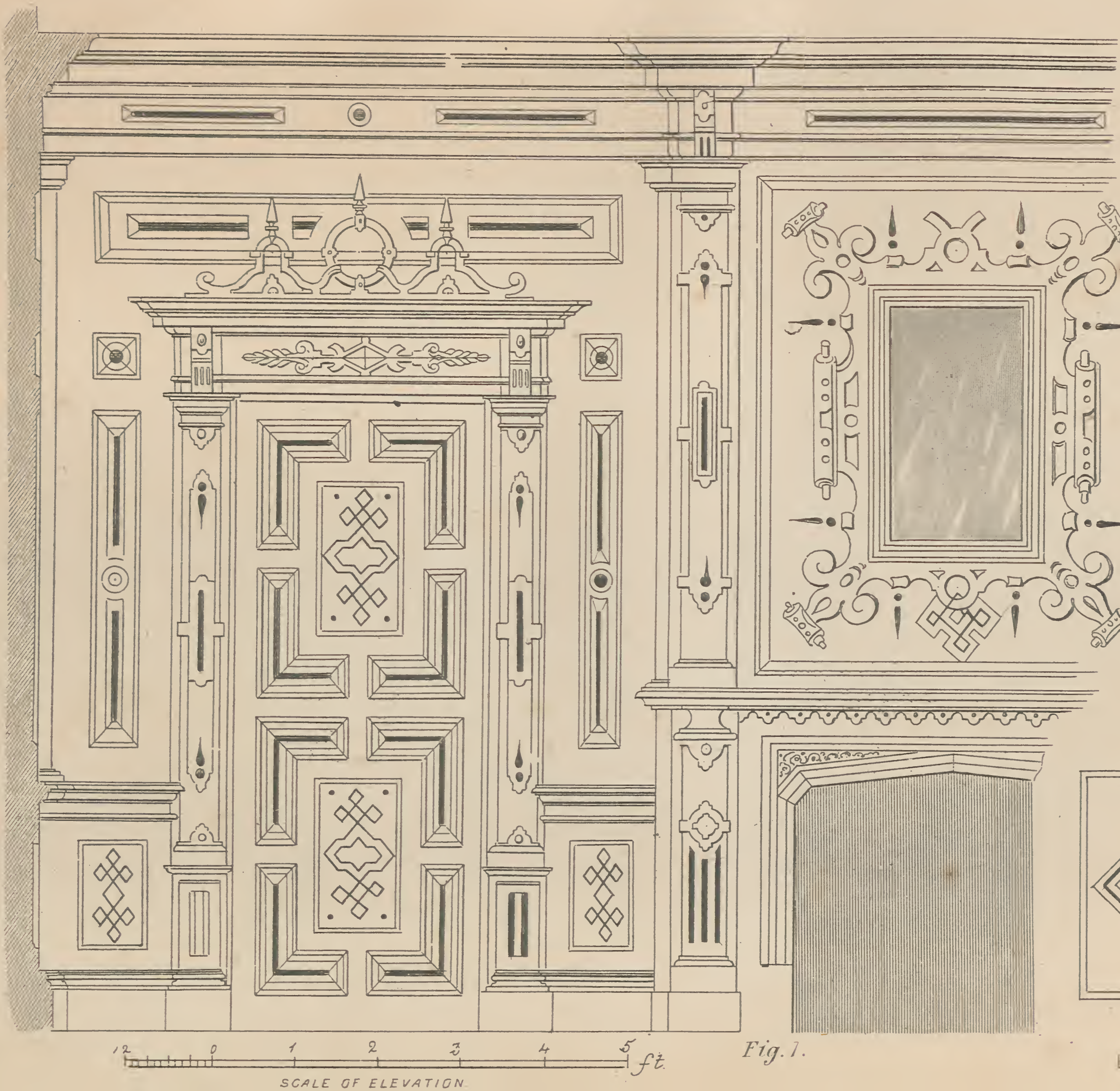


Fig. 1.

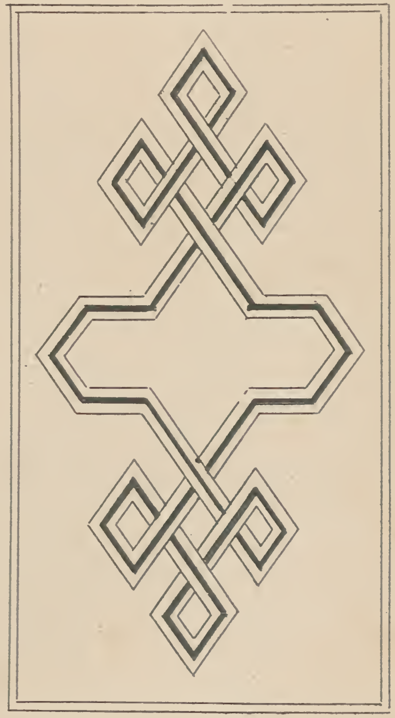


Fig. 2.

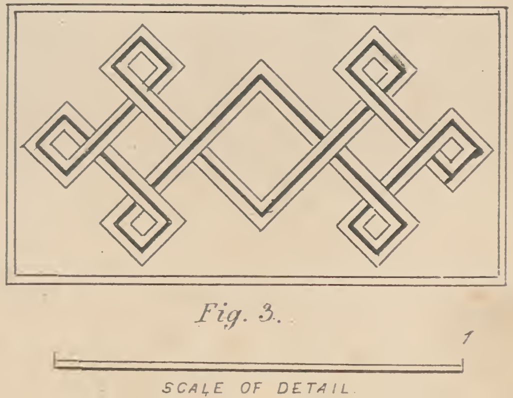


Fig. 3.

Proceeding with the illustration of this particular part of our subject, or wall decoration, as it appeared at a subsequent date to the last example, we give in the succeeding *Plate* 87 two ideas for introductions of the like kind, of Mediæval character, and in *Plate* 88 a design for the wall enrichment of a room in the Elizabethan style.

In the first of these, viz. *Plate* 87, *Fig.* 1 shews the kind of finishing prevalent in rooms about the latter end of the 15th century, the lower part being panelled, the upper part furnished with hangings, and the beams of the ceiling enriched with painted ornaments.

Fig. 2, is in the character of an earlier date; that is to say, about the 13th century. The separation of the wall surface into spaces, to imitate the joints of stone-work, as here shewn, was a usual feature in wall decoration of this, as it was also of the Norman period. Hangings, also used as here represented, were likewise common in the better description of houses, and in many cases were of very elaborate needle-work, either in the shape of powderings, or pictured subjects so executed. They were also frequently of alternate breadths of different colours, or what is called the paned arrangement, sometimes disposed vertically, sometimes horizontally, which is the older practice. Later, the diagonal direction, as shewn in *Fig.* 1, is also apparent. All these peculiarities, it is to be observed, were also occasionally employed, as derived from hangings, in painting on the wall itself; indeed, in many examples of early pictured subjects, the latter are arranged in breadths, evidently with reference to the first appearances of such on the painted cloths or hangings; and, as respects many other kinds of representation, the same source of reference is continually indicated.

It will be noticed in the Plate that but two colours are made use of; a greater number may however, and perhaps more properly, be introduced. In the case of *Fig.* 1, the Tudor colours, or green and white, should, to be quite correct, predominate, relieved by deep red in the hollows, and gold on the fillets and bosses. The heraldic insignia should also be painted in their proper colours. In the case of *Fig.* 2, blue, red, and dark brown should be chiefly, if not wholly employed. Such are the usual colours observed in the wall painting of the early date here designed to be represented.

Plate 88 shews, as before observed, a design for the decoration of an Elizabethan room. This, as will be seen on referring to *Fig.* 1, is proposed to be panelled and inlaid, and enriched with coloured woods and painting. The general ground, or wainscotting, is presumed to be of oak. The inlays would be ebony and rose-wood for the darker portions, satin, box, or other light woods for the lighter; colour being applied to the grounds of the panels for relief against the darker inlays. The ovolos of panels and fillets, &c., should be gilt. The chimney-piece might be of red serpentine, or similar coloured marble. The floor of the room, to accord, should have a parquetted border; and the ceiling of it should be a panelled ceiling, painted in a corresponding fashion.

As respects this latter feature, the introduction of this species of decoration in connection with the painting of the walls of buildings was very early associated. The evidences of this are very numerous, and many specimens, both of the Classic and later periods, have come down to us in a condition fully as instructive and suggestive as the contemporary examples applied to walls. A very usual decoration of the Greek ceiling was a blue ground, studded with

golden stars, in imitation of the firmament; the original idea for which, is probably derived from the actual appearance of the heavens, as seen from the open or roofless hypæthral temple. The reference to this idea is frequently observed in the middle ages, which retained this particular form of roof decoration to the last. Several other peculiarities in the colouring of this latter period appear also to be derived from a Classic source. The spiral bands of alternate colours, so prevalent on the beads and round mouldings of the Gothic age, have their prototypes in Greek and Roman example. Such are found in the temple at Metapontli: indeed, it is considered that the whole system of ornamental colouring in vogue among the artists of the middle ages was derived from the polychromic works of the ancients.*

It is unnecessary, however, to enter into lengthened or particular disquisition on this point: for the present, it is sufficient that the general practice as exhibited at a subsequent period is an admitted retention, shewing itself commonly, as in other parallel cases of art introduction, in a modified shape to suit, or as an adaptation to meet, the requirements of a later date and taste.

To give an account in particular of the many varieties of design exhibited in the painted ceilings of the Classic and after-periods would be next to impossible: a volume would not exhaust all that might be brought forward by way of illustration. We must be content, therefore, to limit the latter to one or two examples in elucidation, and to refer the reader to the few observations we have already made as to their general nature, when speaking of the most usual forms in which painted decorations were introduced. Most of the peculiarities there noticed apply equally to ceilings as to walls, the same general principles of accordance in style and harmony of colour regulating the admissions in either case. Referring briefly, however, and more particularly to the painting of a Greek ceiling, we may direct attention to *Fig.* 3 of the specimens of miscellaneous Classic decoration given in *Plate* 90. This embodies, as will be seen, the same general character and treatment as that shewn in *Fig.* 1, in the same plate, which is a Greek wall decoration, and, to a certain extent, as that exhibited in *Plate* 85, which also professes to be of the Greek Classic type. The remarks made in describing this latter (see page 261), as to colouring, &c., would be in every way applicable to the ceiling here represented.

The succeeding illustration of a painted ceiling, with which we must be content to conclude our exemplification as respects this particular feature, is one of late Tudor character, and which, it may be mentioned, has been executed with a slight alteration only in the colouring, with very good effect. It is the ceiling of a corridor or gallery, ribbed and moulded, as will be seen on reference to *Plate* 89, the intersections being ornamented with hanging bosses, representing baskets of fruit and flowers. The material made use of in the instance alluded to is plaster, but wood would be equally applicable. The general ground of the ceiling should be pale blue or faint green; the hollows of the ribs, white; the fillets, bright red; the beads, gilt, or spirally banded bright blue or deep green and gold; the hollow of the cornice should be blue, and the ground of the ornaments in the large circles may be blue or green, as shewn in *Figs.* 1 and 4.

* See note, page 43 of "Blackburne's Decorative Painting of the Middle Ages."

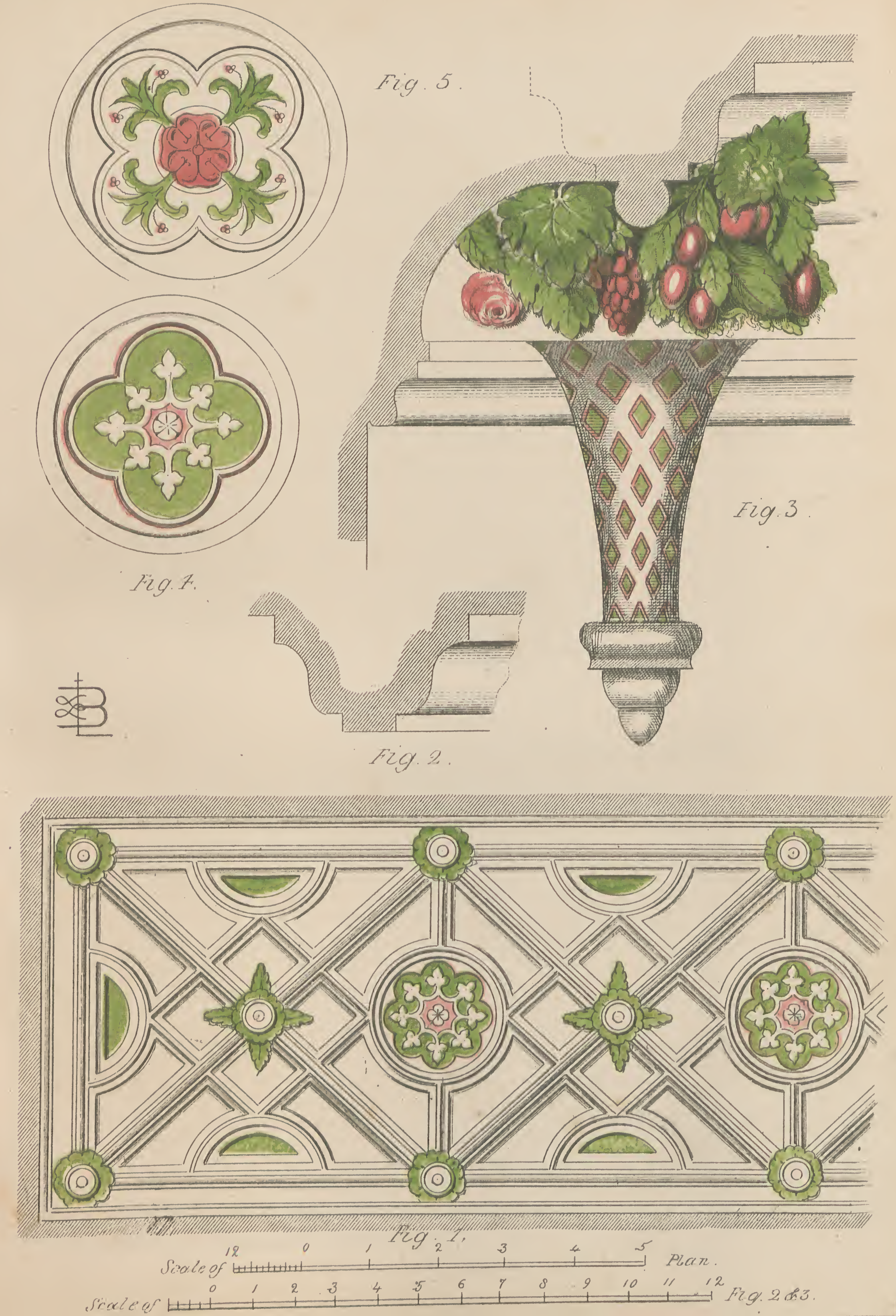


Fig. 5.
Fig. 4.
Fig. 3.
Fig. 2.
Fig. 1.
Scale of 12 0 1 2 3 4 5 Plan.
Scale of 0 1 2 3 4 5 6 7 8 9 10 11 12 Fig. 2 & 3.

Fig. 4.

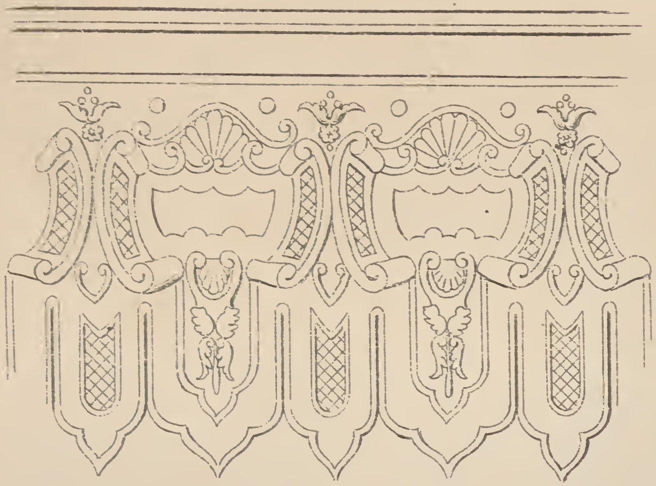
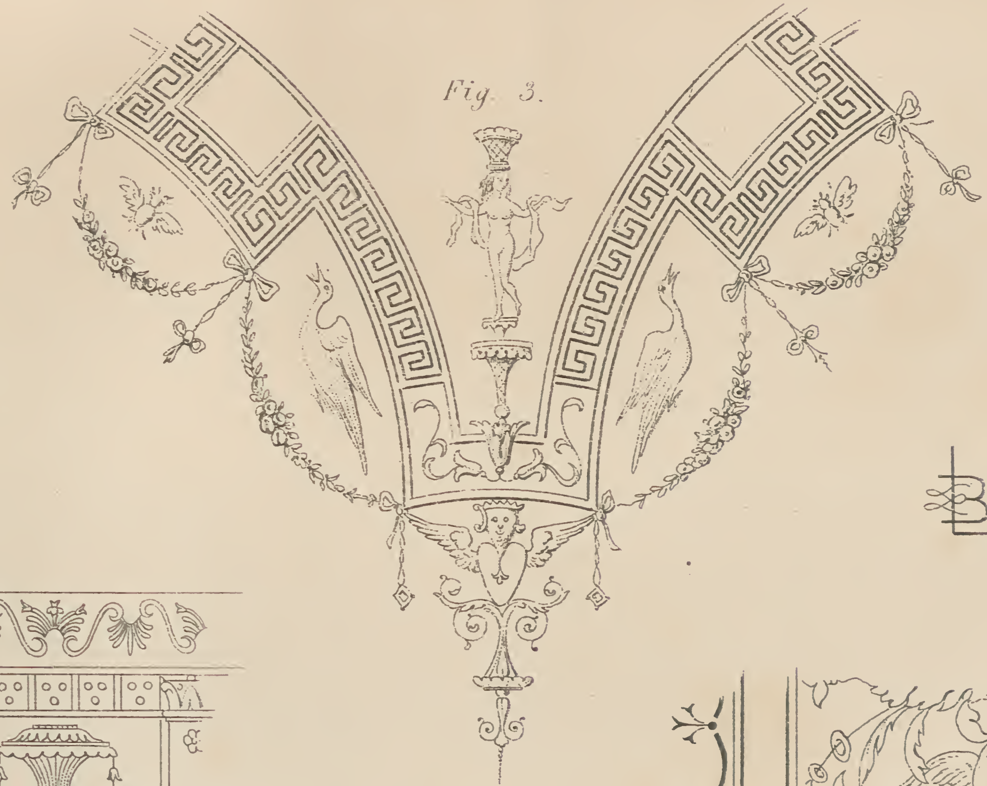


Fig. 3.



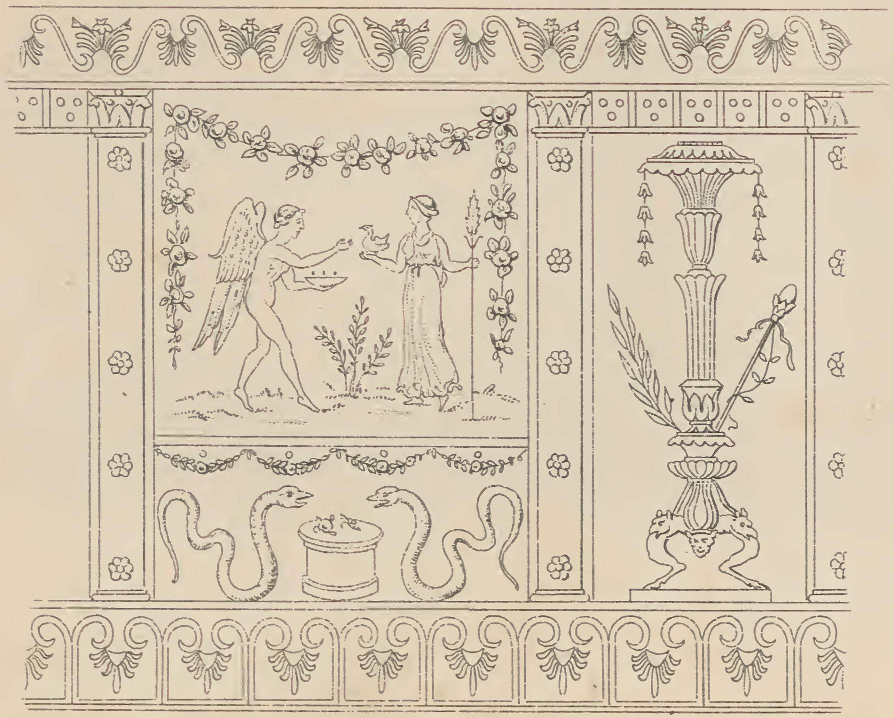
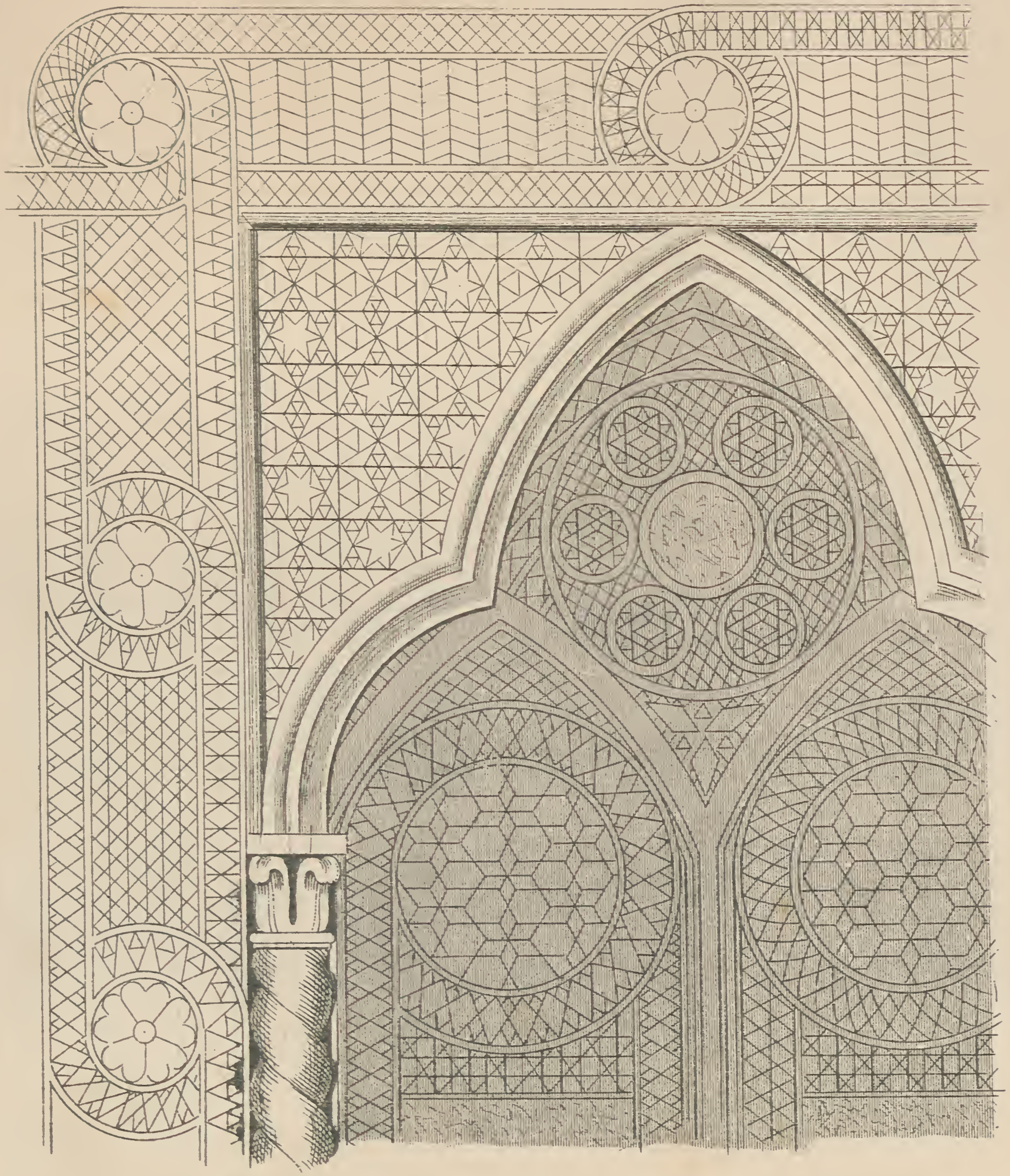


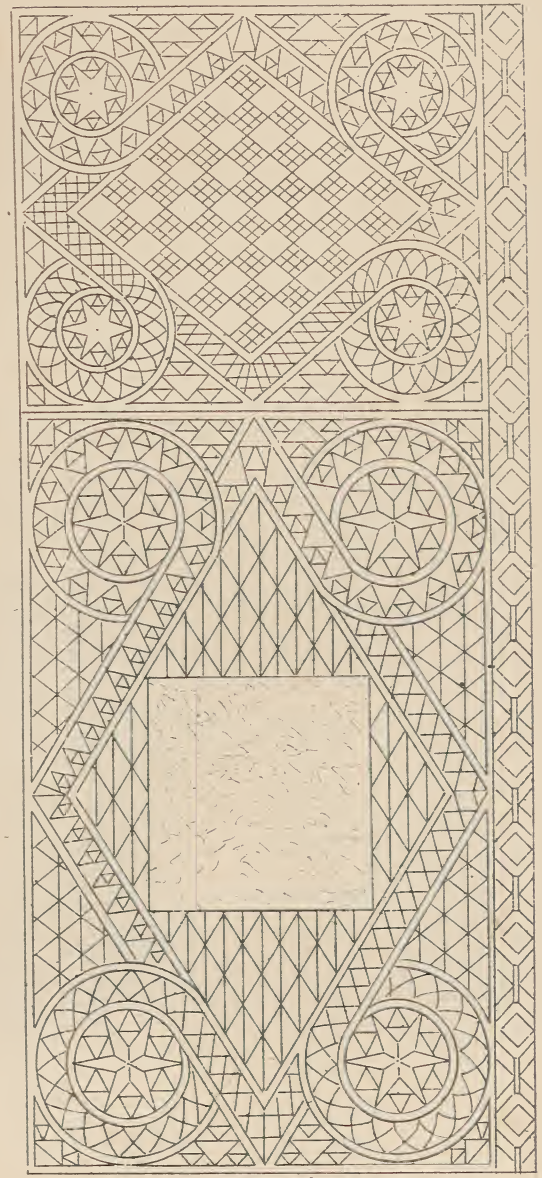
Fig. 1.

Fig. 2.

MISCELLANEOUS DECORATION.—MOSAIC.

PLATE 91.





Scale of 12, 9, 6, 3, 1, 2, 3 Feet.

Fig. 1.

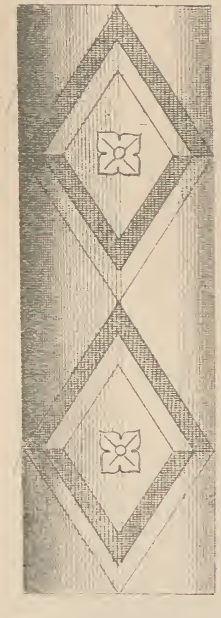


Fig. 6

Fig. 2.

Fig. 4.

Fig. 3.

Fig. 5.

The former of these shews, as will be seen, the plan of the ceiling

Fig. 2, a section of the smaller or inferior ribs;

Fig. 3, a section of the cornice and superior rib, with an elevation of the hanging boss, or basket with its fruit and flowers. These should be in their natural colours.

Fig. 4, shews the ornament on the ground of the circular panels to a larger scale; and

Fig. 5, a second or varied design for the same.

In the remaining plates, viz. those numbered 90, 91, and 92, with which we shall close our subject, returning to general applications, we give a few further illustrations,—in the first case partaking of Classic character, and in the two next, exhibiting a variety of the diapered and powdered forms of surface ornament, as well as of mosaic applications to the same purpose.

Figs. 1 and 3, in *Plate* 90,—the former being a Classic wall decoration adapted from a Pompeian example, and the latter a ceiling decoration in the Grecian style,—have been already referred to.

Figs. 2 and 4, in the same plate, are borders, applicable to wall panelling and a variety of similar uses. The colours in each case should be well contrasted, the grounds being deep solid colour, and the pattern brought out in lighter and more vivid tones. The foliage in *Fig.* 2 should be in bright and soft greens and browns; the birds in natural colours; fruit and flowers the same; the cross lines or hatching in *Fig.* 4, should be gilt, and the outlines might be relieved in the same manner.

Plate 91, will need no further description than saying it represents portions of the mosaic decoration of the tomb of Edward the Confessor, in Westminster Abbey, one of the best and most perfect examples of this species of enrichment which we have in England,—indeed, about the only one, if we except the monument of Henry III., which shews to anything like the same extent the introduction of this particular form of decoration in this country. Abroad, the practice, as is sufficiently well known, is, however, largely exhibited.

Fig. 1, it may be observed, shews a portion of one of the arched recesses in the side of the tomb; and

Fig. 2, part of the ornamentation of the frieze above them.

In *Plate* 92, we have, in *Figs.* 1 and 2, two very beautiful specimens of diapering, formerly existing in the chapel of St. Stephen, at Westminster; and in *Fig.* 3, another variety of the same description of enrichment.

Figs. 4 and 5, are examples of powderings, applied in the same manner as the diapered form, to wall decoration, and very commonly to the backgrounds of figures and other pictured subjects, as well as in other situations. The first mentioned, viz. No. 4, is a portion of a background to a panel painting of one of the Apostles on the screen at Trunch Church in Norfolk; and No. 5, is adapted from the pattern painted on the underside of the rafters in the nave roof at Aldenham Church, Herts. In the first case the ground is green and the flowers gold, the crowning border being also gold. In the second, the ground is bright red, the pattern black.

Speaking of the colour to be used in *Figs.* 1 and 2, there is opportunity for a very rich

effect. In the former, a ground of full blue, or opaque green, the birds and finer lines and figures in the pattern being gold, and the broader lines of the quatrefoils dark brown or black, would produce a pleasing result. In the latter, a clear brown, or light claret coloured, ground, with golden foliage, &c., with the spread eagle in black on bright red, or on a lighter tint of the general ground, would have a very rich and harmonious appearance. In *Fig.* 1, the ground of the circles containing the golden birds might be white, or cream colour, if it were desired to add greater lightness.

Fig. 6, it is to be added, is a pattern of very simple and effective character, taken from the hollow moulding of a niche at Westminster. In the original the ground is red, the parts of the diamond darkened in the plate being blue, the other parts yellow.

We have now arrived at the terminating point of our labours in elucidation of the Mason's, Bricklayer's, and Plasterer's arts, to which we proposed at our commencement to be the guide. No pains, we can truly say, have been spared to make the observations offered, both as regards the theory and practice of each, as comprehensive and useful as possible; and we trust that the result will be correspondingly successful. In relation to that of the Decorator, included in our original plan, we have been less profuse than at first intended, for the reason, in the first place, that this part of the subject is in every way deserving of a more extended consideration than our prescribed limits afford space for; and in the next, that we have desired to violate no promise made to our subscribers as to the extent of our issue, but the rather to keep within it, and in this respect satisfy their want at less than the full cost they may have anticipated; with which they will be better satisfied, we imagine, and justly so, than with excess.

FINIS.